The Veterinary Record

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 3. JANUARY 17, 1942. VOL. 54.

VITAMIN A AND ITS RELATIONSHIP TO SOME OF THE COMMONER DISEASES OF FARM ANIMALS*

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Dr. Barron introduced his paper by giving a short historical summary of the known facts concerning vitamin A. He stressed the fact that the lesions of avitaminosis A in laboratory animals are essentially those of an impairment of the epithelial tissues. While vitamin A is essential to health and to normal vision, extravagant claims have been made regarding its therapeutic value. The chief store of vitamin A in the animal body is in the liver. It does not occur as such in the plant kingdom, but animals are able to convert the substance, carotene, which is found in plants, into vitamin A. Morton (1938) laid down as a guide that mammalia require about 1/40th mg. of vitamin A per kg. bodyweight daily, but this requirement is high according to the estimates of the Californian workers (Guilbert, Miller and Hughes, 1937).

The technique for the estimation of vitamin A in liver and in milk was described with the aid of lantern slides and epidiascope. The results are expressed in " Blue Units " (B.U.) per gramme.

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Introduction

The object of the investigations, which were carried out on cattle, sheep, pigs, fowls and foals, may be briefly summarised under the following two headings :

(1) To observe any effect of the disease upon the level of vitamin A storage in the livers of animals suffering from well-known complaints.

(2) To observe the rate and level of vitamin A storage in the foetal liver up to the time of birth.

From the outset it was appreciated that the so-called normal level might vary enormously according to different methods of management and at different times of the year, but it was felt that, if sufficient material were available, more light might be shed on a problem of considerable economic importance. Moore (1932) examined the vitamin A content of a large number of livers of human patients who had been suffering from different conditions, and endeavoured to correlate the results with the various diseases involved. Sen and Sharma (1936) carried out similar work on the livers of domestic animals in India, but in this country there has to date been little available information concerning the level of vitamin A storage in animals affected by many of the commoner diseases.

* Paper presented to the Central Veterinary Society on March 6th, 1941. The material was taken from a thesis entitled " Vitamin A and its relationship to disease in animals," which was submitted in September, 1940, for the degree of Doctor of Philosophy in the University of Reading.

PART I (SHEEP)

Much work published in connection with the storage of vitamin A in the foetal liver suggests that neither vitamin A nor carotene passes the placental barrier with complete freedom, although the quantities which become stored in the foetal liver are, at least in humans, rather higher when the maternal reserve is high than when it is low (Green, *et al.*, 1931 ; Wollf, 1932 ; Gaehtgens, 1937*a*, 1937*b* ; Roi, 1937 ; Ellison & Moore, 1937). With regard to farm animals, the impression prevails that insufficient vitamin A (or carotene) in the mother's diet may have serious consequences and result in infertility, death *in utero*, abortion, neo-natal death from inanition, or death somewhat later from enteritis and the development of scours. Hart and Guilbert (1937) consider that the foetus may die *in utero* or that abortion, which may be confused with the contagious type, may occur. This is particularly likely to be the case in certain poor grazing areas, where outbreaks may assume an enzoötic character. These authors believe, further, that many calves born alive at term will die during the first few days of life because they have severe diarrhoea and are too weak to stand to suckle. Although lack of vitamin A has been blamed for similar troubles in lambs, the possibility of lamb dysentery does not seem to have been considered. Hart and Miller (1937) maintained ewes on a vitamin A deficient diet until symptoms of night blindness developed. Only 11 out of 17 ewes conceived, and the lambs from them either were born dead or else died within 24 hours of birth. The well-known condition of ophthalmia neonatorum in lambs may well be associated with a vitamin deficiency, although an attempt has recently been made to incriminate certain types of Rickettsia bodies in its pathogenesis.

It was felt that it would be of considerable interest to trace the building up of vitamin A reserves in the lamb's liver before birth and subsequently through life, and to observe whether or not the reserve was influenced in any way by intervening disease. Studies were carried out upon foetal lambs which had been aborted from various causes, and upon others which were removed at autopsy from ewes which had died from pregnancy toxaemia. In some instances the whole lamb was sent to the laboratory by train or post, and a delay of from 20 to 24 hours was unavoidable. In no case, however, were there any marked putrefactive changes in the liver.

The results, together with those of the examination of the milk of Dorset Horn—Border-Leicester cross ewes, are recorded in Tables I to VIII.

Discussion

The work here recorded shows clearly that the foetal lamb does not store vitamin A in its liver to any extent. Some was present in a few instances which may possibly be explained by a variation of placental permeability. That the placenta of the sheep exercises a marked controlling and even selective influence on the various substances coming to it in the maternal blood streams is illustrated by the work of Snook & Godden (1938). These authors, in an investigation of ketonaemia in pregnant ewes observed that ketone bodies were not detectable in the lamb's blood. As they realised, however, there is the possibility that these substances are oxidised when they reach the foetal circulation. Since the blood is immediately carried to the foetal liver this is very possible. Needham (1931) encountered the same phenomenon when testing the permeability of the chorion of the ewe and the cow to sodium salicylate. He found that this substance was definitely held back. Dalling (1928), working on the immunisation of ewes and lambs against lamb dysentery, noted that the lamb received no protection *in utero* but depended upon the first milk for its antibodies. Although, under the conditions of the experiments recorded, no vitamin A was found, it cannot be said with absolute certainty that the developing lamb *in utero* does not receive minimal amounts of vitamin A *via* the placenta. Either there is no mechanism normally present at this stage to provide for storage, or the placental barrier is such that no surplus is allowed through. The possibility that carotene might pass through and be stored as such is hardly in keeping with the known ability of the ewe to convert all her carotene into vitamin A, or with the fact that all the lamb liver-extracts were completely devoid of any yellow colouring matter that would suggest the presence of this substance.

After birth, vitamin A begins to appear in the liver and reserves are rapidly built up until a level of about 400 B.U. per gramme of liver is reached. Disease does not seem to influence the rate of storage to any great extent, with the exception of diseases such as lamb dysentery and parasitic enteritis, which affect the intestinal tract and which may interfere with the absorption of vitamin A. On the whole, however, the normal biological intake is affected only by those diseases which mechanically interfere with the intake of milk, such as tetanus, " swayback " and pneumonic conditions.

Although the average vitamin A content of the colostrum of ewes is low it does not seem to vary so greatly from animal to animal as in the case of the cow. As in this animal, however, it falls rapidly as the colostrum gives place to milk. Thus there will be a large supply of vitamin available during the first few days, which would explain the appearance of a rapidly increasing reserve in the liver in early life. This to a certain extent is borne out by data recorded in Table V, from which it will be seen that the liver reserves of a lamb 2 to 3 weeks old are no greater than of a normal one 6 to 7 days old. The reserves of ewes are in a different category because the ewe has had access to grass and other herbage containing carotene. The results presented in Table II show that the ewe can build up very high reserves of vitamin A in her own liver.

Summary

1. The livers of 59 foetal lambs have been examined for the presence of vitamin A. In three only was there any measurable amount of vitamin, eleven showed a trace and in 45 no vitamin at all was present.

2. A small number of normal lambs between the ages of six days and three weeks were examined. The average number of blue units found in the livers was 400 per gramme.

3. The livers of ten lambs suffering from lamb dysentery were examined. Three of these contained no vitamin A, and the remainder showed reserves which might be considered to be within the normal range for the age.

4. The livers of nine lambs suffering from " swayback " were examined. Whereas five showed vitamin A reserves which could be regarded as within the normal range for the age, four were definitely very low.

5. The livers of 19 lambs varying in age from eight days to nine months and which had suffered from various diseases were examined. In one case of tetanus the vitamin A reserve was below the normal for that age. Two nine-month-old lambs possessed a very high reserve and that of the remainder came within the normal range for the age.

6. The livers of 15 ewes were examined. Twelve of these had been affected with pregnancy toxaemia and all but two carried vitamin A reserves of above 1,000 blue units per gramme of liver. One ewe which died of entero-toxaemia and one affected with parasitic gastritis had comparatively high reserves, but one affected with advanced pneumonia had a very low reserve.

7. The fat percentage and the vitamin A content of ewes' milk was estimated over a period of a fortnight commencing on the day of lambing. The fat content of colostrum was 50 per cent. higher than in normal milk and fell rapidly after the second day. The vitamin A content was low as compared with that of cows and fell rapidly from the first day. At the end of a fortnight it had fallen to one-tenth of its original concentration in colostrum.

PART II (PIGS)

Vitamin A deficiency in the pig has been recognised for some years (see Lienhardt, 1930 ; Dunlop, 1934 ; Guilbert and Hart, 1935 ; Foot, Golding and Kon, 1938). It appears that the incorporation in the diet of 0·5 per cent. cod liver oil will satisfy the needs of the growing animal, and alternatively it has been shown that 1 per cent. may be fed for 3 to 4 months and none thereafter (Foot and Kon, 1938).

Recovery of affected animals may be brought about by turning them out on to green grass. Deprivation of the pregnant sow appears to result in the production of abnormal young (Hale, 1933, 1937 ; Cole, 1937).

[Dr. Barron then gave a synopsis of the symptoms and lesions of avitaminosis A in pigs. The original papers cited were, in addition to the above, those of Sjollema (1938) and Hostetler, Foster and Halversen (1938).]

A study was made of the liver reserves of vitamin A in pigs of varying ages from the day of birth upwards. Unfortunately it was not possible to procure any foetal piglets for comparative purposes. Most

of the piglets came from different farms, although in Table X data are recorded on 22 piglets reared on the same farm. The investigation was planned with a view to ascertaining whether any relationship existed between the liver reserve of vitamin A and any of a number of well-known pig diseases, and the results are presented accordingly in Tables IX to XVIII, and accompanying notes.

Discussion

From the outset the author was conscious of the difficulties which would have to be overcome when the time came for reviewing the levels of vitamin A reserves found in the livers of pigs suffering from various diseases.

In the first place the basal diet of the animals themselves, or of the sow, would materially influence the concentration of vitamin A in the liver. In most cases it was possible to ascertain under what form of management the pigs were being kept and in this connection it was of value to know whether the animals were kept out of doors or not. It was, however, seldom possible to assess the amount of vitamin A or carotene in the concentrate ration. If the contention of Foot *et al.* (1938) is taken as a working basis the position becomes somewhat easier. They concluded that most commercial rations contained little or no vitamin A or carotene.

Secondly, it must not be overlooked that the ability to store the vitamin varies from one individual to another in the same litter on the same food (Foot, *et al.* (1938)). This is a very serious factor to be reckoned with when assessing the true value of the figures obtained. According to the same authors the variation from one animal to another may be as great as ten times.

The third and by no means insignificant factor arises from the difficulty of diagnosis. The problem of differential diagnosis in swine between such conditions as swine fever, pasteurellosis and influenza will be readily appreciated by those associated with the control of diseases of pigs. These diseases have common symptoms and *post-mortem* lesions are often so meagre or atypical that they are of little assistance. History and clinical evidence together are very valuable but when combined with a laboratory investigation a much higher degree of accuracy is possible.

The variation in the vitamin A content of livers of pigs affected with different diseases is clearly shown in Table XVIII. In nearly every group a number of animals had no reserve whatever whilst high figures were recorded for others. The variation was admittedly great but taking into account the age of the animals and those instances where the intestinal tract was affected and where there was a marked lowering of the vitamin reserve, a comparison of the average reveals differences which, although significent in themselves, are not, however, sufficiently striking to be of any diagnostic importance.

In the case of the group affected with roundworms the results suggest that the rate of depletion of vitamin A from the liver is proportionate to the degree of infestation. With regard to the other groups, when the nature of the disease and the age of the animal are taken into account there is evidence to show that the vitamin A reserves tend to be lowered as a result of disease. This is more striking in those instances where the alimentary tract is particularly involved.

Summary

1. The livers of 41 piglets only a few hours old were examined for the presence of vitamin A. Four of these had no vitamin A reserve, 17 had reserves below 100 B.U., 14 of 100 B.U. or more, and 3 over 200 B.U. per gramme. The average number of B.U. for this group was 91.

2. The livers of 18 piglets showing clinical signs of anaemia were examined. Their ages varied from 24 hours to 10 weeks. One had a trace of vitamin, 12 had less than 50 B.U., and 6 more than 50. The low average of 38·6 was recorded for this group.

3. The livers of 14 pigs suffering from necrotic enteritis were examined. Their ages varied from 4 to 14 weeks ; 4 had no vitamin A reserve, 7 had less than 100 B.U., and 3 more than 100 B.U. The average number was 55·7 B.U.

4. The livers of 7 pigs suffering from pasteurellosis were examined. Their ages varied from 8 to 12 weeks. Three had a trace or no vitamin at all and the remainder showed a range of from 13 to 84 B.U. The average was 27·8.

5. The livers of 11 pigs affected with *A. suis* were examined. Six animals, all of which were heavily infected, had a trace or no vitamin A in their livers and the remainder showed reserves varying from 107 to 210 B.U. Average 77·9. The results here suggest that the depletion of vitamin A from the liver is proportional to the degree of infestation.

6. The livers of 14 pigs suffering from swine fever were examined. Two had only a trace of vitamin, two had less than 100 B.U., 4 had more than 100 B.U., and 6 more than 200 B.U. Average 175·9.

7. The livers of 10 pigs suffering from influenza were examined, their ages varying from 4 to 25 weeks. Two had no vitamin A reserves, 3 less than 100 B.U. and 5 more than 100 B.U. Average 133·2.

PART III (CATTLE)

(*a*) *Calves.*

The importance of colostrum for young animals is generally recognised. It is nutritive and possesses purgative and protective (antibody) properties. Among the protective agents it contains, vitamin A must be included. As far back as 1922, Smith and Little showed that coliform and other calf infections developed when the colostrum was poor in vitamin A, and these findings were considerably amplified by Stewart and McCallum (1938*a*). The same authors (1938*b*) showed that the vitamin A content of cows' colostrum might vary considerably on the same diet, but that it seemed to bear a definite relationship to the length of the previous dry period ; in any event it fell rapidly to about one-twentieth the initial level by the third or fourth day after calving. Henry, Houston and Kon (1940) stated that this level was not reached before the fifth day. It is of practical importance to note that cows which milk right up to the time of calving and thus have no dry period in which to build up their reserves, may give colostrum of inadequate vitamin A content.

Lack of vitamin A in the maternal diet may lead to stillborn or weakly calves, or to deficiency symptoms which appear later (Moore and Hallman (1938)). The so-called nutritional scour of young calves deprived of colostrum is probably due to inadequate amounts of vitamin A in pail-fed milk or in that of a foster-mother long since calved. Blindness in

calves (Kuhlman, Gallup and Weaver, 1938; Phillips and Bohstedt, 1938; Moore, 1938) as well as in older cattle (McNutt and Wall, 1938; Lahiri, 1938; Bambauer, 1938) has been attributed to vitamin A deficiency, and the original papers should be consulted for an account of the actual lesions.

The livers of a small number of normal calves and of calves suffering from various diseased conditions were examined. The results, with corresponding notes, are included in Tables XIX and XX.

(*b*) *Adult cattle.*

Many investigations have been made in an attempt to establish some relationship between vitamin A and tuberculosis (see Griffith, 1932; Woolf, 1932; Schneider and Weigand, 1937; Chevalier, Escarras and Paillas, 1938; Kon and Maddock, 1938). On the whole, these efforts have been attended by little success. It was therefore decided to obtain new information on the subject by estimating the vitamin A content of the livers of cows which had been taken under the Tuberculosis Order, and samples, with accompanying case notes, were obtained from veterinary officers of the Ministry of Agriculture. The results, together with those of the analyses of four normal cow livers, are recorded in Table XXI, and show that the livers of the tuberculous animals contained surprisingly high reserves of vitamin A.

Summary

(*a*) 1. The vitamin A content of the livers of six normal, three-month-old calves was estimated. The average number of B.U. per gramme was found to be 121·8.

2. Three calves born prematurely as a result of *Br. abortus* infection of the dam, one calf born dead up to time and four removed from the uterus one month before time, had no vitamin A reserves in their livers.

3. Three calves of various ages which had died from pneumonia had no vitamin A reserves in their livers.

4. Thirteen other calves which had suffered from various conditions had vitamin A reserves in their livers varying from none to as much as 750 B.U. per gramme. Apart from the one showing this high level (which, considering the age might be regarded as normal) only one, which had 450 B.U. per gramme, was outside what might be regarded as the normal range for calves of about three months of age.

(*b*) 1. The livers of four cows free from tuberculosis were examined for their vitamin A content. The average number of B.U. per gramme found was 275.

2. The livers of nine cows condemned under the Tuberculosis Order and one tuberculous heifer were examined for their vitamin A content. The average number of blue units found was 1,390 and the range was from 120 to 2,050.

3. Although in two instances the vitamin A content was only 120 blue units, in the other seven animals it was above the highest level recorded for any liver from a non-tuberculous cow.

4. The vitamin A content of the liver of tuberculous cows was found to be markedly high. It bore no relationship to the extent of the tubercular process.

PART IV (DOMESTIC FOWLS)

Avitaminosis A has been fairly extensively studied in the fowl, in which species relatively large numbers may be utilised for research purposes without great cost. In practice, both young chickens and adult birds may be affected. Young chickens have been described as showing excessive lachrymation, leg weakness, urate deposition in ureter and kidneys, caseous deposits in the bursa of Fabricus and, in some cases, keratinisation of the oesophageal and buccal mucosae. Adult birds develop a fairly characteristic syndrome called "nutritional roup," which is sometimes mistaken for contagious coryza or for infectious laryngo-tracheitis (see Seifried and Westhues (1930), Seifried (1930), Chichester, Russell and Hudson (1938), Hutchinson (1937) and Claussen (1938)).

A study was made of the liver reserves of (*a*) birds suffering from a variety of diseases, and (*b*) birds affected with tuberculosis. The results, with accompanying notes, are recorded in Tables XXII and XXIII.

Summary

1. An estimation was made of the vitamin A reserves of the livers of 24 fowls suffering from various diseases. These included cases of leukaemia, visceral gout, fowl paralysis, tumour formation, coccidiosis and various respiratory infections.

2. Apart from the case of avitaminosis A, the lowest reserves were found in cases of visceral gout, and where extensive damage had been done to the liver by tumour tissue.

3. The chick appears to be able to build up its reserves of vitamin A rapidly from the day it is hatched.

4. No correlation was shown to exist between the extent of tuberculosis and the level of vitamin A reserve in the livers of eight birds examined.

5. There appeared to be no marked correlation between the various diseases and the level of the vitamin A reserves.

PART V (HORSES)

There was little material available for this part of the study, only three foal livers being forthcoming. The analyses are recorded in Table XXIV.

GENERAL SUMMARY

Estimations were made of the vitamin A content of the livers of certain domestic animals, both in health and disease. Details are recorded of 105 sheep and lambs, 134 pigs, 16 cows, 29 calves, 32 fowls and 3 foals as well as 72 samples of ewes' milk.

Whereas the foetal lamb appears to store no vitamin A in its liver and to depend upon its mother's colostrum for its early supplies, the piglet is born with a limited reserve. Evidence presented also suggests that the calf relies very largely upon colostrum for its initial supply of vitamin.

Disease conditions in which gastritis and enteritis are present and certain respiratory conditions (though not tuberculosis) appear to cause a lowering of the vitamin A reserve. In other diseases, there seems to be little, if any, correlation between the vitamin A reserve and the disease process.

The livers of tuberculous cows contained very much greater reserves of vitamin A than did those of non-affected animals.

Owing to the necessity for economising space in consequence of the paper shortage, the tables which follow have perforce been very much curtailed from the original.

Table I : Estimation of Vitamin A in livers of Aborted Lambs.

18 Lambs aborted from 35 days to a few days before full time, due either to *S. ovis* infection or to shock.

Result.—In one instance (seven days premature) 67 B.U. were recorded but in none of the others was any Vitamin A present.

Table II : Estimation of Vitamin A in livers of lamb foetuses from ewes affected with Pregnancy Toxaemia and in the livers of these ewes.

12 Ewes which succumbed to Pregnancy Toxaemia. In only two cases was the Vitamin A content below 1,500 (375 and 600 B.U.). All the others had high reserves, the maximum recorded being 13,666. *4 Ewes*, affected with entero-toxaemia (2), parasitic gastritis (1) and contagious pneumonia (1). The latter only had 50 B.U. per gramme but the others were above 2,000. The livers of *30 Lambs* from these ewes. No more than a trace of vitamin A was found in any of them.

Table III : Estimation of Vitamin A in livers of lambs born dead up to time of diseased and normal ewes.

9 Lambs.—Two had 30 and 10 B.U.s per gramme respectively, the remainder none.

Table IV : Estimation of Vitamin A in livers of Normal Lambs.

4 Lambs.—Average age two weeks. Average B.U. per gramme, 330.

Table V : Estimation of Vitamin A in the livers of lambs suffering from (*a*) Lamb Dysentery, (*b*) " Swayback."

(*a*)

No.	Lesions.	Age.	B.U. per gramme of Liver.	No.	Lesions.	Age.	B.U. per gramme of Liver.
1	Tympanites	24 hours	32	6	Enteritis	4 days	80
2	Impacted bowel	2 days	None	7	Enteritis	4 ,,	286
3	Enteritis	2 ,,	170	8	None	2 weeks	450
4	Enteritis	3 ,,	None	9	Tympanites, Enteritis	3 ,,	380
5	Ulceration	3 ,,	None	10	Enteritis	3½ ,,	190

(*b*) *9 Lambs.*—Age from four days to eight weeks. Average B.U. per gramme, 236. Range, 10 to 574.

The values in (*a*) appear on the whole to be lower than those of normal lambs ; this may be due both to a lowered intake of milk and to interference by toxins with vitamin A absorption. There would appear to be little or no correlation between liver vitamin A reserve and " Swayback."

Table VI : Estimation of Vitamin A in livers of Diseased Lambs.

No.	Disease of Lamb.	Age.	B.U. per gramme of Liver.	No.	Disease of Lamb.	Age.	B.U. per gramme of Liver.
1	Joint-ill	8 days	185	4	Tetanus	5 weeks	30
		10 ,,	100	5	Tapeworm infestation ; heavy	6 months	410
		11 ,,	200	6	? Poisoning ; sugar-beet tops	9 months	2,650
		5 ,,	474				2,000
		17 ,,	40	7	Contagious pneumonia ...	9 months	None
2	Pulpy kidney disease. Lambs on turnips and kale, then rape	4 weeks	210	8	Parasitic gastro-enteritis (*H. contortus*)	6 months	None
		3 ,,	300			6 ,,	300
		4 months	400			6 ,,	Trace
		8 ,,	875			8 ,,	175
3	Pasteurellosis	4 weeks	210			4 ,,	375

The figures fluctuate considerably and there seems to be no obvious indication that they are in any way connected with the particular disease present.

Tables VII and VIII : The Fat percentage and Vitamin A content of ewes' milk up to the tenth day.

Time of taking sample	Initial.	48 Hours.	4 Days.	6 Days.	8 Days.	10 Days.
Average fat percentage	11·5	7·6	7·1	8·6	8·7	7·8
Average number of blue units per gramme of fat ...	56·1	21·7	10·0	5·8	4·8	5·6

Samples were taken on the day of lambing, and on alternate days subsequently, from 13 Dorset Horn cross Border-Leicester ewes. Six samples, each of about 30 ml. were taken, the first being drawn within an hour of parturition. The first samples were typical colostral milks, being pale yellow or greenish in colour and markedly tenacious. Sometimes, the samples taken 48 hours later were also slightly coloured, but the majority appeared quite white and of normal fluidity. It is seen that the vitamin A content falls to about 1/10 of its initial concentration as the colostrum changes to milk. This is comparable with the data for cows' milk recorded by Dann (1934).

Tables IX and X : Estimation of Vitamin A in livers of piglets at birth.

41 Pigs examined.—Average blue units per gramme, 100. Range, none to 215.

Table XI : Estimation of Vitamin A in livers of piglets suffering from Anaemia.

18 Pigs examined.—Average blue units per gramme, 38·6. Range, trace to 150. Average age, 4½ weeks.

Table XII : Estimation of Vitamin A in the livers of young pigs (Necrotic Enteritis).
14 Pigs examined.—Average B.U. per gramme, 55·7. Range, trace to 195. Average age, twelve weeks.

Table XIII : Estimation of Vitamin A in livers of young pigs (Pasteurellosis).
7 Pigs examined.—Average B.U. per gramme, 27·8. Range, none to 84. Average age, ten weeks.

Table XIV : Estimation of Vitamin A in pigs affected with *A. suis*.
11 Pigs examined.—Average B.U. per gramme, 77·9. Six had none, maximum 210. Average age, twelve weeks

Table XV : Estimation of Vitamin A in livers of pigs affected with Swine Fever.
14 Pigs examined.—Average B.U. per gramme, 175·9. Range, trace to 614. Average age, twelve weeks.

Table XVI : Estimation of Vitamin A in livers of pigs affected with Piglet Influenza.
10 Pigs examined.—Average B.U. per gramme, 133·2. Range, none to 273. Average age, ten weeks.

Table XVII : The Storage of Vitamin A in the livers of pigs on a Deficient Diet.

No.	History.	Disease.	Age.	B.U. per Gramme Liver.
1	Sows kept indoors. Piglets dying with no symptoms. P.M. : acute gastro-enteritis. In many instances the stomach also showed small irregular, star-shaped ulcers	Vitamin A deficiency	3–4 weeks	None, trace, none, 12, none, none, 40, none, trace, none, none
2	Ration contained over 60 per cent. maize. P.M. : gastritis with ulceration, cirrhosis of liver	Nutritional imbalance	10–14 weeks	80
3	Ration contained over 60 per cent. maize. P.M. : gastritis with ulceration, cirrhosis of liver	Nutritional imbalance	11 weeks	102·5

The gastric ulcers were in some cases similar to those described by Foot *et al.* (1938). This form of ulceration is not characteristic nor necessarily indicative of swine fever.

Table XVIII

Table No.	Disease Recorded.	Age.	Average B.U. per Gramme of Liver.	Range.	Figures of Foot *et al.* (93).
	On fattening ration + 20 c.c. C.L.O. daily	20 weeks			35·250
9 & 10	Piglets, ? normal	few hours	100·0	0–215	86·2
11	Anaemia	16 hours–8 weeks	38·6	0–150	118·7
12	Necrotic enteritis	4–20 weeks	55·7	0–195	
13	Pasteurellosis	8–14 ,,	27·8	0–102	
14	Ascaris infection	8–20 ,,	77·9	0–210	
15	Swine fever	3–20 ,,	176·0	0–614	
16	Swine influenza	4–25 ,,	133·0	0–375	

In order to facilitate comparison, the average figures from the preceding tables are here grouped together.

Table XIX : Estimation of Vitamin A in livers of unborn calves.
10 Calves examined.—From three months premature up to full time. 210 B.U. present in two calves, the remainder showed no vitamin A.

Table XX(a) : Normal Calves, all approximately three months old.

No.	Weight of Liver in Grammes.	B.U. per Gramme.	No.	Weight of Liver in Grammes.	B.U. per Gramme.
1	1,596	125	4	1,192	62
2	1,240	44	5	912	75
3	1,140	200	6	1,824	225

Table XX(b) : Estimation of Vitamin A in livers of calves from birth upwards.

No.	History.	Disease.	Age.	B.U. per Gramme.
1	Cow calved to time but needed assistance. Calf was weak and developed pneumonia on fourth day	Pneumonia	4 days	None
2	Calves dying of scour and general debility ; had intussusception ; no *post-mortem* lesions apart from slight enteritis	Nutritional scour	7 ,,	Trace
			7 ,,	None
3	Reared indoors under poor conditions	*Bact. coli* infection	9 ,,	Trace
4	Born and reared out of doors. Poor from start ; always unthrifty. No scour	Inanition and exposure	9 ,,	88
5	Born and reared out of doors. Poor from start ; always unthrifty. No scour	Inanition and exposure	11 ,,	450
6	Calf developed scour a few days after and failed to respond to treatment	Salmonella infection	2 weeks	150

No.	History.	Disease.	Age.	B.U. per Gramme.
7	Winter-reared calf; never did well and did not respond to treatment or special diet	Nutritional scour	16 days	250
8	Calves all suffered from severe scour from end of first week	Salmonella infection	20 ,,	80
9	Calves put on to artificial diet at two days old	Starvation	4 weeks	190 84
10	Calves kept indoors from birth and only on milk	Lead poisoning	4 months	None
11	One of a batch kept in an open yard. Pasteurella isolated from spleen, kidney and lungs	Contagious pneumonia	4 ,,	None
12	Calves dying in an advanced stage of emaciation	Johne and parasitic gastritis	6 ,,	80
13	Calves out of doors developed severe pneumonia; several died. Pasteurella organisms isolated in pure culture from lungs	Johne and parasitic gastritis	6 ,,	80
14	Chronic parasitic enteritis and husk with mild broncho-pneumonia, being out on river meadow	Parasitic enteritis	18 ,,	None
15	A batch of calves wintering in a large park died of acute enteritis	Sodium silicate poisoning	18–20 months	750 150 250

In a number of instances it is quite clear that the disease has had a marked effect upon the Vitamin A level. It seems to be lowered in those instances, *viz.* 2, 3, 8, 10, 14 and 15, in which intestinal disturbance was marked. In the case of 1, 12 and 13, all of which had suffered from pneumonia, there was no reserve. This agrees closely with the comparable data for sheep (see Table II).

Table XXI: Estimation of Vitamin A in the livers of Normal cows and of Tuberculous cows taken under the Tuberculosis Order.

Normal Cows: 4 examined.—Average B.U. per gramme of liver, 350.
Tuberculous Cows: 10 examined.—Average B.U. per gramme of liver, 1,296. Range, 120 to 1350.

Table XXII: Estimation of Vitamin A in livers of Fowls.

History.	Age of Bird.	Appearance of Extract.	B.U. per Gramme.
Leukaemia	18 months	Pale yellow	195
	18 ,,	Water clear	None
Visceral gout, with peritonitis	14 ,,		150
Visceral gout; kidneys, liver and heart involved	8 ,,		250
Fowl paralysis. Killed in early stages. Gastric nerves enlarged. Heavy capillaria infection	8 ,,		205
Fowl paralysis. Swollen proventriculus	7 ,,		400
Sarcoma. Liver extensively involved	12 ,,	Pale yellow	75
Sarcoma—liver, lungs and kidney	18 ,,		30,000
Large white tumour, weighing 358 grammes in abdominal cavity	10 ,,		4,000
Birds in battery layers. Lymphomatous tumour growths in liver	8 ,,	Deep golden	1,900
Most of liver destroyed by sarcomatous growth	11 ,,		Trace
I.L.T. Died in advanced stages. Birds kept in battery layers	12 ,,		2,666
Air sac infection	8 ,,		440
Iritis, cystic kidneys; ascarids and coccidia present	10 ,,		4,000
Poor condition, ascarids and coccidia in intestines	14 ,,		5,000
Avitaminosis A, oesophageal lesions	12 ,,	Bright yellow	None
No lesions } Apparently normal birds	4 weeks	Pale yellow	820
,,	6 months		380
,,	8 ,,		2,200
,,	11 ,,		1,900
Coccidiosis. Caecum and intestine	6½ weeks		1,050
Coccidiosis, caecal form	8 ,,		7,000
Nutritional disturbance. Caeca distended and containing a caseous wad	6 ,,		1,650
Bacillary White Diarrhoea	3 days		21

I.L.T. = Infectious Laryngo-tracheitis.

Table XXIII: Estimation of Vitamin A in the livers of Tuberculous Fowls.

8 Birds examined.—Average B.U. per gramme of liver, 1015. Range, 100 to 4,000.

The great variation from bird to bird was noted. There seems to be no correlation between the vitamin A reserve and the type and extent of the lesions present. As in the case of tuberculous cattle livers, it was necessary to employ red units in addition to the yellow units in matching up the colour of the extracts after the addition of $SbCl_3$.

Table XXIV: Estimation of Vitamin A in livers of Foals.

3 Animals examined.—No. 1—Five days old affected with Joint-Ill, 116 B.U. per gramme. No. 2—48 hours old affected with so-called " bruised heart," 42 B.U. per gramme. No. 3—36 hours old affected with so-called " bruised heart," no vitamin A.

References

[A selected list of references is given in full as recommended by the late Professor Nuttall. As such, they should prove of value to other than specialist readers. First-hand information only is given, and the names of the periodicals are abbreviated according to the *World List of Scientific Periodicals.*]

Bambauer, —. (1938.) Contagious Keratitis in Cattle. *Tierärztl. Rdsch.* **44.** 188-190. Cited in *Vet. Bull., Weybridge.* **8.** 718.

Chevallier, A., Escarras, A., and Paillas, J. (1938.) Influence of the reserve of Vitamin A in the Liver on the Pleural Reactions in the Guinea Pig. *C. R. Soc. Biol. Paris.* **128.** 916-917. Cited in *Nutr. Abstr. Rev.* **8.** 603.

Chichester, D. F., Russell, W. C., and Hudson, C. B. (1938.) Mortality in Poultry Flocks and the Vitamin A Content of the Livers of Pullets and Hens. *Poultry Sci.* **17.** 505–510.

Claussen, L. (1937.) Histogenesis of Pustules on the Oesophageal Mucosa of Fowls with Avitaminosis A. *Dtsch. tierärtzl. Wschr.* **45.** 161-164. Cited in *Vet. Bull., Weybridge.* **8.** 173-174.

Cole, L. J. (1937.) The Importance of Threshold Characters in Animal Breeding. *Proc. Amer. Soc. Anim. Prod.* 30th ann. Meet., 291-296.

Dalling, T. (1928). Lamb Dysentery. *Vet. Rec.* **40.** (N.S. 8.) 841-842.

Dann. (1934.) The Transmission of Vitamin A from Parents to Young in Mammals. III. Effect of the fat content of diet during pregnancy on the transmission of vitamin A to the foetal rat. *Biochem. J.* **28.** 634-637.

Dunlop, G. (1934.) Paralysis and Avitaminosis A in swine. *J. agric. Sci.* **24.** 435–456.

Edwards, J. T. (1937-38.) Carotene (or Vitamin A) Deficiency and some Common Unsoundnesses in Horses. *J. R. Army vet. Cps.* **9.** 3-23 and 60-82.

Ellison, J. B., and Moore, T. (1937.) Vitamin A and Carotene. XIV. The vitamin A reserves of the human infant and child in health and disease. *Biochem. J.* **31.** 165-171.

Emmel, M. W. (1940.) The Hematology of Avitaminosis A in Dogs and Rabbits. *J. Amer. vet. med. Ass.* **97.** 145-148.

Foot, A. S., Golding, J., and Kon, S. K. (1938.) The Vitamin Requirements of Pigs. Publication No. 462 of the National Institute for Research in Dairying, Shinfield, Reading.

——— and Kon, S. K. (1938.) Vitamin supplements in Practical Pig Feeding. *J. Minist. Agric.* **45.** 913-919.

Fox, D. L. (1936.) Structural and Chemical Aspects of Animal Coloration. *Amer. Nat.* **70.** 477-490.

Gaehtgens, G. (1937a.) Excretion of Vitamin A during Pregnancy. *Klin. Wschr.* **16.** 52-53. Cited in *Nutr. Abstr. Rev.* **7.** 171.

———. (1937b.) Determination of Carotene and Vitamin A in the Blood of Pregnant Women, and Determination of Carotene and Vitamin A Content in the Blood of the Umbilical Cord. *Ibid.* 893-984 and 894-895. Cited in *Nutr. Abstr. Rev.* **7.** 439.

Green, H. N., Pindar, D., Davis, G., and Mellanby, E. (1931.) Diet as a Prophylactic Agent against Puerperal Sepsis, with special reference to Vitamin as an Antifective Agent. *Brit. med. J.* **2.** 595-598.

Guilbert, H. R., and Hart, G. H. (1935.) Minimum Vitamin A Requirements with particular reference to Cattle. *J. Nutrit.* **10.** 409-427.

———, Howell, C. E., and Hart, G. H. (1940.) Minimum Vitamin A and Carotene Requirements of Mammalian species. *J. Nutrit.* **19.** 91-103.

Guilbert, H. R., Miller, R. F., and Hughes, E. H. (1937.) The Minimum Vitamin A and Carotene Requirements of Cattle, Sheep and Swine. *J. Nutrit.* **15.** 543-564.

Hale, F. (1933.) Pigs Born without Eyeballs. *J. Hered.* **24.** 105-106.

———. (1937.) The Relation of Maternal Vitamin A Deficiency to Microphthalmia in Pigs. *Tex. St. J. Med.* **33.** 228.

Harris, L. J., Innes, J. R. M., and Griffith, A. S. (1932.) On the Pathogenesis of Avitaminosis A. *Lancet.* **223.** 614-620.

Hart, G. H. (1940.) Vitamin A Deficiency and Requirements of Farm Animals. *Nutr. Abstr. Rev.* **10.** 261-272.

———. and Guilbert, H. R. (1937.) Symptomatology of Vitamin A Deficiency in Domestic Animals. *J. Amer. vet. med. Ass.* **91.** 193-200.

——— and Miller, R. F. (1937.) Relation of certain Dietary Essentials to Fertility in Sheep. *J. agric. Res.* **55.** 47-58.

Henry, Kathleen M., Houston, J., and Kon, S. K. (1940). The Vitamin A and Carotene Content of Shorthorn Colostrum. *J. Dairy Sci.* **11.** 1-8.

Herrin, R. C. (1940.) Gastric Emptying Time and Acidity in Avitaminosis A in Dogs. *Amer. J. digest. Dis.* **7.** 164-166. Cited in *Nutr. Abstr. Rev.* **10.** 293.

Hostetler, E. H., Foster, J. E., and Halversen, J. O. (1938.) Vitamin A Deficiency—a Cause of Lameness and Death among Swine. *Tech. Bull. N. C. agric. Exp. Sta.* No. 52.

Hutchinson, J. K. (1937.) *Aust. vet. J.* **7.** 2, 93-98.

Kon, S. K., and Maddock, C. (1938.) Experiments on the Effect of Vitamin A Deficiency on the Resistance of Pigs to Tuberculous Infection from Naturally Infected Milk. *Vet. Rec.* **50.** 1693-1697.

Kuhlman, A. H., Gallup, W. D., and Weaver, E. (1936.) Two Types of Blindness in Cattle and their possible Relation to Vitamin Deficiency. *J. Dairy Sci.* **19.** 433-434.

Lahiri, L. M. (1938.) Night Blindness and Cataract in Bullocks. (A deficiency disease ?) *Indian vet. J.* **15.** 58. Cited in *Vet. Bull., Weybridge.* **9.** 418.

Lederer, E. (1935.) Les Caroténoides des Animaux. *Actualités sci. industr.* **238.** *Exposés de chimie biologique.* III. pp. 62.

Linton, R. G., and Brownlee, A. (1939.) Vitamin A Content of the Livers of a Hundred Healthy Dogs. *Nature, Lond.* **144.** 978-979.

McNutt, S. H., and Wall, J. F. (1938.) Nutritional Blindness in Steers. *Vet. Med.* **33.** 497-499.

Mellanby, E. (1938.) Nerve Degeneration and Bone Hypertrophy induced in Young Animals by Diet. *J. Physiol.* **93.** 42-43. (Proc.)

Moore, T. (1932). Vitamin A Reserves of the Human Liver in Health and Disease. *Lancet.* **223.** 669-674.

Moore, L. A. (1938.) Relationship between Carotene, Blindness due to Constriction of the Optic Nerve, Papillary Oedema and Night Blindness in Calves. *J. Dairy Sci.* **21.** 114.

——— and Hallman, E. T. (1936.) Production of White Spotted Kidneys in Calves. *J. Dairy Sci.* **19.** 434-435.

Morton, R. A. (1938.) On Recent Vitamin Studies. *Vet. Rec.* **50.** 1169-1172.

Needham, J. (1931.) "*Chemical Embryology.*" Cambridge : University Press.

Phillips, P. H., and Bohstedt, G. (1938.) Effects of a Blindness-producing Ration on Rabbits. *J. Nutrit.* **15.** 309-319.

Rimington, C. (1937.) The Occurrence of Carotinoids in Animal Sera : the danger of mistaking Carotinaemia for Bilirubinaemia. *J. S. Afr. vet. med. Ass.* **8.** 7-9.

RIMINGTON, C., and FOURIE, P. (1938.) A Rapid Phase Test for Distinguishing between Carotinoid and Bile Staining of Fat in Carcases. *Onderstepoort J. vet. Sci.* **10.** 439-441.

ROI. (1937.) Vitamin A Reserves in the Liver of the Foetus and of the Infant in the First Year of Life. *Pediatria.* **45.** 416-420. Cited in *Nutr. Abstr. Rev.* **7.** 172.

SCHNEIDER, E., and WEIGAND, H. (1937.) Urinary Excretion of Vitamin A in Disease. *Klin. Wschr.* **16.** 441-443. Cited in *Nutr. Abstr. Rev.* **7.** 171.

SEIFRIED, O. (1930.) Studies on A-Avitaminosis in Chicks. I. Lesions of the respiratory tract and their relation to some infectious disease. II. Lesions of the upper alimentary tract and their relation to some infectious diseases. *J. exp. Med.* **52.** 519-531 and 533-538.

——— and WESTHUES, M. (1930.) *Arch. wiss. prakt. Tierheilk.* 223-235.

SEN, K. C., and SHARMA, G. K. (1936.) Estimation of Vitamin A reserve in the Livers of some Farm Animals. *Indian J. vet. Sci.* **6.** 128-140.

SJOLLEMA. (1938.) Recent Work on Avitaminosis. *Tijdschr. Diergeneesk.* **63.** 1141-1153 and 1226-1240. Cited in *Vet. Bull., Weybridge.* **8.** 246.

SMITH, T., and LITTLE, R. B. (1922.) The Significance of Colostrum to the New Born Calf. *J. exp. Med.* **36.** 181-198.

SMITH, D. T., PERSONS, E. L., and HARVEY, H. I. (1937.) On the Identity of the Goldberger and Underhill Types of Canine Blacktongue. Secondary fuso-spirochaetal infection in each. *J. Nutrit.* **14.** 373-381.

SNOOK, L., and GODDEN, W. (1938.) The Sugar and Total Ketone Content of the Blood of Ewes and of their New-Born Lambs. *Biochem. J.* **32.** 2037-2039.

STEWART, J., and MCCALLUM, JENNIE W. (1938a.) The Vitamin A Content of the Colostrum of Dairy Cows. *J. agric. Sci.* **28.** 428-436.

———. (1938b.) "White Scour" in Calves and Related Infections. 1. The significance of the vitamin A content of the colostrum as a predisposing factor in the causation of such conditions. *J. comp. Path.* **51.** 290-295.

WOLFF, L. K. (1932.) On the Quantity of Vitamin A present in the Human Liver. *Lancet.* **223.** 617-620.

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Discussion by the Central Veterinary Society

Mr. ALASTAIR N. WORDEN* (St. John's College, Cambridge), who opened the discussion, said: I think we have many reasons for offering Norman Barron our hearty congratulations. He has carried out some painstaking work of high merit, he has presented us to-day with a clear but necessarily brief account of that work, and has left us in no doubt as to the importance of vitamin A in animal nutrition and therapeutics; last, but not least, he has successfully submitted a thesis based on his work for the degree of Doctor of Philosophy in the University of Reading. [Applause.]

Before entering into a detailed discussion of any part of Dr. Barron's paper, I think we might profitably ask ourselves "What is vitamin A?" There exists in nature a series of non-nitrogenous fat-soluble, polyene pigments, collectively termed the "carotenoids." These substances have an extremely wide distribution in both the plant and animal kingdoms, although they are absent as such from certain species, notably from certain mammals such as the pig. Many of the brilliant red, orange and yellow hues of birds, reptiles, fishes and invertebrates are due to the presence of carotenoids, *e.g.*, the coloured shell and eggs of the lobster, and the pink muscles of the salmon (Fox, 1936). The chief point at the moment, of course, is that some of these compounds may, if absorbed, be broken down enzymotically in an animal's liver (or by some correspondingly-situated mechanism in lower forms of life) to yield the colourless compound we term "vitamin A." I believe it is a fact that whereas phytoplankton, the small plant-forms which drift in marine or fresh water, contain carotenoids only, the zoöplankton, or corresponding animal forms, contain vitamin A as well. It is of great practical importance to know which carotenoids yield vitamin A, and in what plants or other foods these active forms occur. It is as well to emphasise that it is because of its alcohol structure that vitamin A can form compounds with fatty acids, bile acids and proteins, from which can be explained its "absorption from the intestine as a bile acid compound, its transportation in the blood and lymph as fat acid ester, its storage in the liver as similar compound, the apparent occurrence of protein-vitamin A compound as precursor to the visual purple of the retina, and the appearance of free vitamin A in non-saponifiable extracts from vitamin-A-containing oils and fats"; because it is an alcohol it can be separated quite readily from carotenoid precursors. (Gortner, *Outlines of Biochemistry*, New Ed., 1938.)

We have had ample evidence this afternoon of the indispensability to man and animals of vitamin A: the second question we might put to ourselves is "What is the value of determining the vitamin A content of the liver?" Dr. Barron did not mention their paper, but some of you may recall that Linton and Brownlee (1939) at the "Dick" College, estimated the vitamin A reserves of 100 allegedly healthy dogs, and found a very great degree of variation. In 23 of their animals described as being lean or in poor condition, the lowest value obtained was 11, the highest 2,800, B.U. per gramme liver! Nevertheless, it is possible to apply a commonsense interpretation to the results of these estimations, and when they are collected together they begin to form, in conjunction with other data, a highly interesting story. Dr. Barron has been careful to stress the limitations of his work, but that does not detract from the fact that he has confirmed or established some very significant points. The first of these points is that the foetal lamb, and probably the foetal calf and foal also, have negligible liver reserves of vitamin A, but that a certain amount does appear to be present in foetal pig liver. Together with this we may consider the high values for vitamin A found in ewe colostrum. An absence of vitamin A has dire consequences for the young animal: if further proof of the essential need for colostrum were required, we have it here. It was known that, apart from its "physiological properties," the colostrum of some species, notably the sheep, contained antibodies which were believed not to have been able to pass the "placental barrier," and Dr. Barron has now confirmed very substantially that the "anti-infective" vitamin is passed on in the same way as the antibodies. In what manner some young lambs thrive after being deprived of colostrum is a matter for conjecture, but it would appear to be a matter of sound husbandry to attempt to provide as rapidly as possible a source of vitamin A for any young animal so deprived. The appearance of traces of vitamin A in the foetal pig is interesting: possibly it is linked up in some way with the fact that the pig must break down all the active carotenoids it absorbs to vitamin A. As I mentioned earlier, the pigments themselves are absent from the pig.

The second point established by Dr. Barron is that vitamin A reserves in the livers of tuberculous cows are

* Mr. Worden's remarks were illustrated by tables showing the nature and distribution of vitamin A and related compounds. Interested readers are referred to the summary in *Nature, Lond.* 1940. **145.** 286-288, and to the relevant references cited at the end of Dr. Barron's paper.

high, and that the extracts of the livers of such cows are strongly pigmented. I may say that these observations, upon which I will not dwell further now, have attracted attention elsewhere, and that we shall probably have more of them anon. It should be mentioned that in 1930, Buckley and his collaborators noted parenchymatous degeneration and intense carotenosis in bovine livers found during meat inspection (see Hart, 1940).

The third major point is, that apart from the lowered values of certain cases which Dr. Barron has discussed, there does not seem to be any obvious correlation between a lowered vitamin A reserve and disease, unless, of course, the disease be some manifestation of avitaminosis A. I don't think that this is surprising. Vitamin A has been termed "anti-infective" because in its absence there is a sequence of changes favouring infection of certain types. An animal cannot exist without a source of vitamin A any more than it can without available nitrogen, or fat, or magnesium, or any other dietary essential, and in its absence certain changes occur leading to a state of disease. The whole picture of disease-resistance is, however, much more complicated than that of a simple lack of vitamin A, and it would be the height of empiricism to attempt to treat any and every infection with some form of the vitamin. It might be expected, of course, that a nutritionally sound animal, one which had adequate reserves of vitamin A amongst other standbyes, would resist many infections better than would a vitamin-A deficient animal. Dr. Barron has reminded you of the work at Reading in which pigs receiving large doses of vitamin A failed to stand up to an experimental tuberculosis any better than did vitamin-deficient animals. This was, of course, only a single, simple, drastic experiment, from which it would be wrong to conclude that vitamin A has no part to play in disease-resistance as a whole; what it does make abundantly clear, if such proof were needed, is that A does not play the *whole* part in disease-resistance. It must be confessed that we know very little indeed of the relationship between nutrition and infectious disease. There are so many perplexing factors, among which we include the findings which Dr. J. T. Edwards made a few years ago, *viz.*, that when well-fed white rats were inoculated with a strain of foot-and-mouth disease virus, they developed more rapid local lesions and a greater susceptibility to generalisation than did similarly treated animals which were receiving a diet of bread and milk only. The differences were more striking in the case of the males.*

What is the position of the clinician? I think it might be summarised as follows. The clinician should familiarise himself with the manifestation of avitaminosis-A in the animals with which he is concerned, and should learn what foods are rich in vitamin A and its precursors. In this country it is highly important that all who have to deal with the pig should be so informed, and, owing to the varying conditions under which they live, it is essential to ensure an adequate A intake for those mammals and birds which are maintained as pets. Nor is it probable that all members of the domestic species in this country remain free from partial deficiencies of A. If a suspicion that there has been a vitamin A deficiency has arisen too late, at least one can despatch a portion of the dead animal's liver, preserved in 5 per cent. potash solution, for an estimation. Random analyses of this type would, in the aggregate, add considerably to the information which Dr. Barron has already collected.

* Fifth Report of the Foot and Mouth Disease Research Committee, 1937.

In conclusion, I should like to make a few remarks about some of the species.

Ox.—Cattle tend to accumulate carotene, and not xanthophyll; hence feeding a xanthophyll-rich substance such as yellow maize does not lead to an increased pigmentation of the tissues, whereas the consumption of foods rich in carotene does lead to such an increase. The fat and blood-serum of cattle contain appreciable quantities of carotene, particularly in the Channel Island breeds, in which carotene occurs even in the skin secretions. There is a popular dislike of yellow fat, which, as Hart (1940) has pointed out in his recent review, has little to support it except the fact that there is a tendency for the colour to increase in intensity with age, and that an animal which has been well "finished" on concentrates is likely to have a whiter fat than one which has received grass throughout. This question of pigmentation is of importance to meat inspectors: as Rimington (1937) pointed out some years ago, there is a danger of mistaking carotinaemia for bilirubinaemia, and in the abattoir itself it becomes necessary to distinguish between bile and carotene staining. Experienced inspectors are said to be able to distinguish the two conditions by visual examination; others hang the suspected carcase for 24 hours, by which time the carotene is said usually to have disappeared by oxidation, while bile staining will remain unchanged. Nevertheless, it has been said that bile staining may disappear overnight, which fact would presumably permit of an animal normally rejected to be sold as usual, and Rimington and Fourie (1938) have devised a rapid phase-test, applicable in the abattoir, to distinguish between the two conditions.

The high pigmentation of certain breeds of cattle, notably the Channel Island breeds, although leading to a more richly-coloured milk, does not necessarily imply that the total vitamin A content of the milk will be higher. A breed such as the Friesian has a much whiter fat, and similarly its milk is much whiter. Nevertheless, there may be quite as much total vitamin A activity in the milk of a Friesian as in the milk of a Jersey; it is merely the case that the Friesian converts its carotene to vitamin A more completely than does the Jersey (see Maynard, *Animal Nutrition*, 1937). The importance of the cow as a source of vitamin A in human dietaries has been stressed by Virtanen (*Cattle Fodder and Human Nutrition*, 1938), who states that if the milk and milk products used in winter can be brought up to summer standards, any deficiency of vitamin A in Finnish winter diets generally disappears.

Pig.—This is the domestic species most liable to vitamin A deficiency under farm conditions in this country. It is probable, as Professor Miller pointed out to me some years ago, that not only may there be acute effects upon young growing pigs, but also cumulative effects upon stock shown only after the third generation. Many of the losses which have been encountered among indoor pigs, *e.g.*, those due to lowered fertility, lessened mothering ability, low milk production, slower growth rates of progeny, and, perhaps, lower disease resistance, may well be due to a cumulative A deficiency. We are still in need of information upon these vital points, although much has been done at Reading upon certain aspects of A deficiency in the pig. I thought quite recently that it might be of considerable value to utilise in future vitamin A studies on the pig the partial hepatectomy technique developed by Professor Wright who, you will recall, successfully operated at intervals upon growing pigs in order to remove samples of liver for Mr. White's experimental cirrhosis studies.

Fowls and Other Birds.—It has been clearly shown that the fowl requires vitamin A, and it is apparent from poultry

husbandry, as well as from experimental work, that carotene will act as the provitamin. Emslie (1934) stated, in summary, that "When yellow maize is over 25 per cent., when there is a good deal of alfalfa leaf meal (over 10 per cent. in an otherwise vitamin-A poor ration) or at least 1·5 per cent. of cod liver oil a deficiency of this vitamin is improbable. This is also the case when the birds have access to a good grass range. Under the conditions now prevailing in most countries, vitamin A deficiency has ceased to be a serious problem, at least for growing chickens." Unfortunately, one might add to-day that in most countries the conditions of 1934 in regard to animal nutrition no longer obtain.

Birds as a group tend to store not carotene (to any appreciable extent) but the related carotenoid pigment, xanthophyll or lutein, which itself appears to be inactive as a source of A. (Lederer, 1935.) Some birds apparently retain the unchanged pigment in their feathers; others, including certain canaries, the goldfinch, greenfinch and siskin, convert it to another yellow pigment, named "canary xanthophyll," which is different from any plant pigment. Feeding a ration rich in xanthophyll to a White Leghorn fowl produces a rapid coloration in all parts of the body, but does not, of course, have any effect whatever upon the vitamin-A content of the bird. Similarly, most of the pigment of egg-yolk is due to xanthophyll, so that a richly-coloured yolk is not direct evidence that the egg is a good source of vitamin A.

Horse.—In a characteristically thorough review, Dr. J. T. Edwards (1937-38) has provided us with a complete discussion of the whole field. There has, however, been one notable finding since, *viz.*, that of Guilbert, Howell and Hart (1940) who have determined experimentally the minimum vitamin A and carotene requirements of the horse. Their values are included in the accompanying table. Night blindness was the first symptom noted in their studies, and xerophthalmia did not develop.

Carnivores.—Although the dog and cat are not included in Dr. Barron's paper, they are of interest to most of you here. I have quoted Linton and Brownlee's figures, and these and other investigations do indicate that the vitamin A intake of the domestic dog must vary enormously. It has been clearly shown that the dog at any rate is highly susceptible to a deficiency of vitamin A, and among the many sequelae of such a deficiency may be: a preliminary upset in the white blood cell picture (Emmel, 1940); an anorexia, the mechanism of which has been studied to some extent (Herrin, 1940); deafness (Mellanby, 1938); necrotic lesions in the oral mucosa (the "Underhill type of canine black tongue"); and the final more generalised and advanced lesions. As Smith and his colleagues pointed out (Smith, Persons and Harvey, 1937) the same groups of organisms may invade the oral mucosa of the dog both in vitamin A deficiency and in nicotinic acid deficiency; it is possible, therefore, to have the same lesion arising from two quite unrelated vitamin deficiencies.

Mr. Worden concluded by making a point about references. The 143 references in Dr. Barron's thesis were, as they appeared there, of value only to the specialist, whereas if put in greater detail (see Nuttall, *Notes on the preparation of papers for publication in the Journal of Hygiene and Parasitology* (1940) they would be of general interest to many members of the profession. A selected list of Dr. Barron's references, together with those cited by Mr. Worden, have been set out in detail according to the Harvard plan and are published as such in this issue.

Dr. STABLEFORTH said that he did not come there prepared to say very much, but he did wish to take that opportunity of expressing his appreciation of Dr. Barron's efforts to find out something for them about vitamin A in relation to the diseases of animals. He was afraid they knew very little about the subject up to the present time, and he thought, in spite of the large amount of data he had given them that day, many of them, or he might say most of them, had seen that there was a very great need for further data so that they could get a general picture of the liver vitamin A content and the probable requirements of animals for vitamin A.

He had shown them what the values were in small groups of animals, but he found it very difficult to follow him in some respects because, obviously, our information was not yet quite sufficient. What he would like to see, and he expected they would all like to see, would be a chart showing what the vitamin content was for an animal just born, and how it rose—some sort of standard to which they could go back, and then measure or appreciate just what the figures were for animals in various stages.

He hoped Dr. Barron would go on with the work; it was of particular importance to them at the moment, because some of them were proposing to study the effect on certain pig diseases of the decrease or increase in the amount of vitamin A given in the way of cod liver oil. All these things were of interest, and the same interest arose in connection with calves; he hoped in the course of a few years they might be able to get a good deal more information on what he thought was quite an important subject. Although Dr. Barron did not specially suggest that they should buy tuberculous liver, he should like to know if he thought it was of particular value.

Mr. SCOTT DUNN thanked the essayist for his paper. He had the pleasure of being at college with his father, and he remembered Dr. Barron as a small boy. He was not particularly big to-day, but he was growing [laughter] and his work was growing and it would no doubt be continued to their advantage in the future.

Dr. Barron had talked about the difficulties of diagnosis of pig diseases. He (the speaker) had been attempting to diagnose pig diseases for about 35 years, but he had not got very far forward, and he was glad to know that lack of vitamin A did cause disease in this species.

Captain DUNLOP MARTIN, who also expressed his appreciation of the paper, asked Dr. Barron if he had found anything in connection with deafness in the white bull terrier being improved, or whether it could be treated with any satisfaction by administering vitamin A. He remembered that the subject was being tackled at Mill Hill, but he had not so far heard of any results. The same thing occurred to him with regard to the deafness of the white or cream cat, which was not infrequently affected in the same way. Could Dr. Barron tell them anything about it?

Mr. WORDEN said that he thought he might, with Dr. Barron's permission, answer that point. In Mellanby's puppies which were subjected to an A deficiency there was a bony overgrowth of certain parts of the skull, leading to a pressure on and stretching of certain nerves, which eventually degenerated. A labyrinthitis, with degeneration of various parts of the sensory epithelium, eventually developed. If he remembered rightly, at least one ear from a deaf bull terrier was subjected to histological examination by a special technique during his time at the Royal Veterinary College. He understood that there was marked abnormality of the Organ of Corti within the labyrinth, but he did not think that there was any suggestion whatever that such a condition was due to a vitamin A deficiency. He imagined that the deafness in this and other white breeds was due to some genetic factor which was responsible for the structural abnormality.

Dr. BARRON expressed the hope that he had given them something to think about. If there were no more questions he would like to thank them very much for their reception of the work that he had presented on vitamin A deficiency, and also to thank Mr. Worden for his comments, which rather tied up many of the tag ends that were left over by his paper. He was sorry it was not more practical, but he sincerely trusted that they had enjoyed it.

THE VETERINARY RECORD

January 17th, 1942.

A-AVITAMINOSES IN ANIMALS

THE findings reported in Dr. Barron's paper which is printed in this issue, essentially corroborate what was already fairly well known, namely, first that there is little or no storage of vitamin A in the foetal liver and, secondly, that there appears to be little or no correlation between the concentration of this vitamin stored in the adult liver and the concurrent existence of disease in the adult subject. An interesting exception to the latter statement seems to emerge from Dr. Barron's researches in so far as storage of the vitamin in tuberculous subjects was found to be abnormally high. Apart from the real value of the paper in providing data which substantiate statements in the literature that have already behind them a considerable measure of support from experimental evidence, the facts reported in the paper are not at first sight such as to elicit reflection in the mind of the veterinary reader. Viewed more closely, however, they assume a deep significance. Even though the foetal liver does not appear able to store a reserve of vitamin A, there is very strong evidence that the animal organism demands an adequate supply of this vitamin during foetal life; otherwise, in extreme cases of deficiency, grave disturbances may be visible at birth, and, in less severe cases, organic disturbances may persist as chronic lesions, especially of the nervous and neuro-muscular system, throughout adult life. We may quote, as an example of the graver disturbances on record, the classic conclusions drawn in 1933 by Hart and Guilbert* from studies upon cattle exposed to unusually prolonged (nine months) vitamin A deficiency during the dry-feed season in California. The symptoms most commonly seen were :—

" (1) Birth of dead or weak calves with or without eye lesions and associated with retention of the placenta. The condition simulates contagious abortion.

(2) Severe diarrhoea in weak new-born calves which simulates white scours.

(3) Eye lesions, particularly in immature animals, which simulates infectious keratitis."

Congenital blindness in calves in various parts of the world has now been definitely associated with vitamin A deficiency.

In other species, such as the pig and dog, a deficiency of this vitamin during foetal life may lead to the appearance in the subject after birth of predominantly neuro-muscular disturbances, which seem to be very similar to the common conditions, shivering, stringhalt, and possibly roaring, seen in horses—so much so that it is not improbable that these " unsoundnesses " of horses have in reality for their causal origin a vitamin deficiency which had afflicted them in an early, pre-natal, stage of their nurture.†

The inference would be that a sufficiency of this vitamin must traverse the placental barrier for healthy formation of the tissues, notably of the epithelial and nervous systems, of the offspring, failure to achieve which may result in lingering debility of these systems throughout subsequent life. An adequate supply of the vitamin or its precursor in the food of the dam during pregnancy would, therefore, be essential for healthy reproduction. After birth of the young, when it rapidly draws on the large concentration of the vitamin normally present in the colostrum for healthy functioning of its alimentary tract and when storage of the vitamin in the liver begins to become possible, again the nutrition of the dam would be of prime importance.

It is hoped that facilities will be provided for the prosecution of further studies which will have as their aim the extension of our knowledge of the relationship between the reserves of vitamin A in the liver of the dam and the peculiar manifestations of disease which may appear in the progeny, right up to adult life, of the various species of domesticated animals. Our information in this respect is now meagre, and it would be of paramount veterinary importance to have exact experimental evidence upon the relationship.

In so far as no striking depletion of the reserves of vitamin A in the liver takes place throughout a wide range of severe illnesses it would be idle to administer this vitamin, or preparations reputed to contain it, to patients suffering from such illnesses in attempted therapy. One of the abuses, it may be said, with which the rapid increase in our knowledge of the vitamins was beset in its early stages, was that it was grievously exploited by commercial interests alleging specific therapy from administration of such preparations, when often in reality no substantial evidence was available to show that treatment in that way conferred any benefit.

* Hart, G. H., and Guilbert, H. R. (1933.) *Calif. Agr. Exp. Sta. Bull.* **560**. 1-30.

† For a review on this subject see Edwards, J. T. (1937-38.) *J. Roy. Army Vet. Corps.* **9**. 3-23, 60-82.

CONDEMNED MEAT INCREASE

It was stated at a meeting of Hexham Rural Food Control Committee that there was an alarming increase in the amount of condemned meat at the local slaughterhouse. Mr. R. H. Darlington said that in 1938 the total weight of meat condemned was 329 stones; in 1939, 970 stones; and in 1940, 3,126 stones. For a period of eleven weeks, from September 13th to November 28th, this year, 1,016 stones had been condemned.

Mr. Darlington thought that butchers should be compelled to state the quality of the meat offered.

* * * * *

Weekly Wisdom

It is our misfortune to live in a bad period, but it will end. . . . And, so, to the man tempted by despair, I say: Remind yourself that the world is what we make it, and to the making of it each one of us can contribute something. This thought makes hope possible; and in this hope, though life will still be painful, it will be no longer purposeless.—Bertrand Russell in the November issue of *Reader's Digest*.

CLINICAL COMMUNICATIONS

Schistosomum Reflexum

JOHN A. LEE, B.SC., M.R.C.V.S.,
UTTOXETER, STAFFS.

Subject.—Second-calf Shorthorn cow.

History and Examination.—She showed signs of commencing calving on August 16th, but these passed off and the cow seemed normal except for indifferent appetite. The owner sought advice on August 23rd—one week later—when the following condition was found.

The sacro-sciatic ligaments had tightened up again, the vulva admitted the hand only with difficulty, the cervix was completely dilated and occupied by the unruptured foetal membranes which were very thick and tough. They were ruptured with some effort, and two fore legs, two hind legs and a head were found all presenting together. The legs were of unequal sizes and the joints were immovably fixed in various degrees of flexion. It was not possible to reach further than the bases of these limbs, which seemed all to arise from the dorsal surface of a short distorted trunk.

Procedure.—Epidural anaesthesia was induced and both fore limbs and the head and neck were amputated with the wire saw embryotome and removed. One hind limb was then disjointed at the hip and removed. By now the trunk could be drawn back by traction on the remaining hind limb, when the open abdomen could be felt. The trunk was then divided with the wire saw and the whole removed. The foetal membranes were removed easily. Involution was rapid and progress uninterrupted.

Recent reports in the *Record* have told of such cases being dealt with with little trouble, whereas this case required some time and patience. It would quite probably have been easier had advice been sought a week earlier, before the vulva and other structures contracted again.

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Brachyplegia in a Kitten ?

H. LALL, B.SC., M.R.C.V.S.,
GRIMSBY

Subject.—A kitten, aged one month.

History.—Normal and playful until 18 hours before it was brought for inspection.

Symptoms.—The kitten lay on its side and was crying. It could not move its forelegs, which were rigid and extended backwards. It could move the hind limbs and by their aid it could turn over. There was some loss of sensation in certain regions of the limbs. Respirations were rapid and mostly abdominal in type. The abdomen was slightly distended. The eyes were bright and clear. When attempts were made to feed the kitten with a spoon, it would bite upon the spoon but made no effort to swallow. There was no evidence of injury or of localised pain.

The kitten was kept under observation for 24 hours, *i.e.*, until it died.

A tentative diagnosis of paralysis of the brachial plexus on both sides was made.

Post-mortem Examination.—There was froth at the mouth. The stomach and intestines were empty. The sigmoid colon and rectum were full of firm faecal matter. The lungs were congested and the liver slightly enlarged. The brain, spinal cord and brachial plexus were examined. No macroscopic lesion was found.

Was my diagnosis a correct one ?

ABSTRACTS

[**VITAMIN A DEFICIENCY IN HORSES.** HOWELL, C. E., HART, G. H., and ITTNER, N. R. (1941.) *Amer. J. vet. Res.* **2**. 60.]

The authors survey briefly some of the work of recent years in connection with the results of vitamin A deficiency in horses. They note the hoof changes observed by Kleinolov in Finnish Army horses, the debility reported by Chatelain and Edwards, and the night blindness observed by Meadows in Persia. They point out that the idea of a single systemic disturbance being associated with the abnormalities of bones and joints of horses has been held by some people since 1904. They quote Mitchell's hypothesis connecting certain of the unsoundnesses of horses with a dietary origin and the work of Kelser and Callender on equine degenerative arthritis in U.S. Army horses in the Panama Canal zone. They set themselves to produce data to show the effect of combined vitamin A deficiency and varying calcium and phosphorus ratios, with particular reference to joint lesions.

The animals they used were pure bred Percherons of ages varying between 119 and 444 days at the start of the experiment, seven colts and four fillies. The rations on which they were fed contained barley, oats, wheat bran, linseed meal, beet pulp and cotton-seed meal, having a carotene content of 0·01 to 0·02 mg. per 100 grammes. In some cases this was supplemented by barley straw with a content of 0·05 to 0·1mg. of carotene per 100 grammes. The animals were divided into five groups and the rations arranged so that the Ca/P ratios were as follows: 1:5, 1:1, 1:7, 1:1, 2:1. The experiments extended over a period of about two and a half years.

One animal died from other causes and of the other ten all showed night blindness after periods varying between 236 and 501 days on the deficient diets. There was irregular opaque streaking of the cornea, but no evidence of permanent blindness due to pinching off of optic nerves in the optic canals. Lachrymation was associated with this and all animals showed capricious appetite, progressive weakness, and eventually death. In all cases there developed joint involvement with lameness and rarefying lesions in the joint cartilages and in a number of cases there were incordination and symptoms resembling "shivering."

The authors point out that they have not obtained positive evidence that the joint condition was due primarily to vitamin A deficiency. The evidence does point that way but against this is the fact that avitaminosis A usually produced lesions in epithelial tissue whereas joint structures are of mesoblastic origin. Certain reproductive difficulties were observed and the growth curves of the animals were very variable. The authors found that the varying of the calcium-phosphorus ratio of the diets did not seem to play an important rôle in the nutrition of the animals.

D. W. B. T.

[VITAMIN A STUDIES WITH RATS AND PIGS. Braude, R., Foot, A. S., Henry, K. M., Kon, S. K., Thompson, S. Y., and Mead, T. H. (1941.) *Biochem. J.* **35**. 693-707.]

The vitamin A activities of carefully purified preparations of zeaxanthin, vitamin A alcohol, vitamin A ester and β carotene were assayed on pigs and rats. For the experiments on pigs, three litters were used, divided up into five groups, and the rat experiments consisted of four groups, each of four males and five females.

Zeaxanthin was found to be biologically inactive for both species. Pigs made less efficient use of β carotene than rats and required, to cover their minimal requirements, about 300 I.U. of β carotene or 100 I.U. of preformed vitamin A daily per 10 lb. live weight. No difference was found in the biological activities of vitamin A alcohol and vitamin A natural ester for either pigs or rats.

D. W. M

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[WAR-TIME FEEDING OF PIGS. Reid, J. W. (1941.) *J. Min. of Agric.* **48**. 94-98.]

In wartime, with the reduced supplies of foods such as weatings, barley meal, flaked maize and fish meal, the farmer must either cut down the number of pigs kept to correspond with the available supply of those foods or else supplement those foods with other emergency foods to make the reduced quantities go further. The latter course is the one recommended since more pigs can be kept, and home-grown foods, other than cereals, such as acorns, artichokes, cabbages, kale, mangolds, potatoes, silage and swedes, and farm waste products, such as brassica waste, sugar beet tops and whey, also household waste, including swill and industrial wastes such as bakers' sweepings and damaged grain, can be utilised fully for pig feeding.

The amounts of these emergency foods required to replace 1 lb. of barley meal are given and their merits and the methods to be adopted in using them are briefly stated. Extra care is required when using emergency foods. The best foods available should be fed to pigs at the critical periods of their life, *i.e.*, at 3 to 12 weeks old and from one month before farrowing until 4 to 6 weeks after farrowing. Young pigs are not capable of dealing with foods rich in fibre and, though older pigs may be fed increasing quantities of these, care is necessary as pigs cannot digest roughages so effectively as can cattle. However, it is possible by the intelligent use of supplementary foods to reduce the quantity of meal fed to a bacon pig from approximately 6 cwts. on a full meal ration to about half that amount.

The Lehmann system of feeding is described.

A. B.

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[POULTRY FEEDING IN WAR-TIME. Mason, A. T. M. (1941.) *J. Min. Agric.* **48**. 98-100.]

On a commercial farm in East Kent the method of increasing the reduced supply of poultry food was to supplement the available supplies of the usual peace-time foods with emergency ones. The equipment (with costs) used for cooking and mashing potatoes is given and that used for cutting up, very finely, carrots, *Brassicae*, peas, beans, etc., is described and illustrated. The proportions of the various ingredients used might vary, but usually 12 to 14 cwts. of cooked potatoes, about 4 cwts. of raw cut vegetables, 3 cwts. of balanced meals and sufficient meat or fish meal to bring the protein content up to accepted standards, were mashed and thoroughly mixed. The mash, to give best results, must be of the proper consistency and stoneground pea haulms were found excellent for drying too wet a mash. The great importance of adequate protein is emphasised.

Such methods give results economically sound, though it is not claimed that they are the best or easy methods of feeding poultry. However, by such means, use is made of many foods which are at certain seasons surplus to the requirements of the people and good results can be attained.

A. B.

IN PARLIAMENT

The following questions and answers are amongst those recently recorded in the House of Commons :—

Agriculture : Dairy Herds

Mr. Price asked the Minister of Agriculture whether there has been a decrease of the number of dairy cattle and calves as a result of the ploughing-up policy ; and whether steps are being taken to show that by arable dairy farming the dairy herds of the country will actually be increased ?

The Minister of Agriculture (Mr. R. S. Hudson): The answer to the first part of the Question is, "No, Sir," and to the second, "Yes, Sir."

Mr. Price : Can the right hon. Gentleman say whether any steps have been or are to be taken to prevent the slaughter of dairy heifer calves ?

Mr. Hudson : I am glad to say that the marketing of calves is well below that of the corresponding period of last year.

. . . . .

Unsound Meat (Collection, Hull)

Mr. Muff asked the Minister of Health whether he is aware that an inspector attached to the Ministry of Food has instructed the health department of the Hull Corporation that, in future, unsound meat must be collected at the same time, and in the same conveniences, as edible fats, dripping and bones ; and, in view of the probable danger to health owing to contamination, whether he will take steps to ensure that the corporation shall continue the separate collection of unsound meat ?

Mr. E. Brown : I have received certain reports from the corporation on this subject and am in communication with my right hon. and Noble Friend the Minister of Food with regard to it.

. . . . .

Phenol (Supplies)

Captain Elliston asked the Minister of Health whether, in view of his appeal for economy in the use of phenol and its homologues, and the possibility of a shortage of these products, he is satisfied that adequate provision is being made for essential supplies to be available for the hospital and health services ?

Mr. E. Brown : Coal-tar, from which many essential war products are obtained, is also the source of phenol and its homologues, and the allocation of the available supplies of coal-tar calls for constant attention. There must be economy in the use of the phenol derivatives, but adequate provision will continue to be made for hospital and health services.

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Cats (Trapping)

Lieut.-Commander Tufnell asked the Home Secretary to what extent the information of the Metropolitan police

shows that there has been illegal trapping of cats in the London area for the sake of their skins which, owing to the restriction of imports, are much in demand by furriers ?

Mr. H. Morrison : I am informed that no such case has come to the notice of the Metropolitan police during the past six months.

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Paper (Rationing)

Mr. Garro Jones asked the Parliamentary Secretary to the Ministry of Supply whether, up to October 30th last, publications had been allotted paper on a percentage of the pre-war consumption of individual publications or on each publisher's total requirements ; and, if on the latter basis, what restraint was placed on large consumption of paper by publications useless in the war effort ?

Mr. Harold Macmillan : Up to November 30th last, a publisher was allowed paper for periodicals on the basis of pre-war consumption of all his periodicals and it was left to each publisher to determine how his ration should be allocated between them. Paper is now, however, allotted to a publisher on the basis of each of his periodicals separately and is not interchangeable. Starting with the current licensing period, which began on November 30th last, paper is now allocated to each periodical separately by reference to a basic period.

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Jan. 20th.—R.C.V.S. Committee Meetings, Royal Station Hotel, York.

Jan. 21st.—10 a.m., Registration Committee, R.C.V.S., Royal Station Hotel, York.

Jan. 21st.—2 p.m., Council Meeting, R.C.V.S., Royal Station Hotel, York.

Jan. 30th.—Meeting of the Sussex Division, N.V.M.A., at Brighton, 2 p.m.

Feb. 4th.—Meeting of the Section of Comparative Medicine of the Royal Society of Medicine, at 1, Wimpole Street, W.1, 2.15 for 2.30 p.m.

Feb. 5th.—Meeting of the Central Veterinary Society at the Conway Hall, W.C.1, 2.15 p.m.

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The Profession and Fire Prevention Duties

The Association has now received from the Ministry of Home Security a reply to the further communication which was addressed to the Ministry in view of the unsatisfactory nature of the intimation that the Minister could not agree to make special provision for the release of veterinary surgeons from the fire watching obligations imposed by the Civil Defence Duties (Compulsory Enrolment) Order.

In this reply it is stated that " the Minister has no reason to doubt that local authorities will be ready, without special instructions, to release veterinary practitioners temporarily if, on an occasion when they are on fire prevention duty, their professional services are urgently required elsewhere." Accordingly, members of the Association should consult their senior fire guards with a view to making the necessary arrangements.

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A.R.P. Animals' " Iron Rations "

To facilitate the making of arrangements for the issue of " iron rations " of foodstuffs to A.R.P. homes for animals, Veterinary Officers are asked to notify the Director of Veterinary Services of the number of these homes in their areas (giving addresses) where provision has been made for the housing in case of need of a minimum of twelve animals for a period of seven days or so.

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National Health Insurance

We would draw the attention of those of our readers who are concerned to the fact that, as from January 5th, 1942, all employees receiving up to £420 per annum became insurable.

Under this extension of the scope of the National Health Insurance Acts, contributions were increased by 2d. a week, of which 1d. may be deducted from wages. The total weekly contribution for a man is now 2s., and for a woman 1s. 7d.

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PERSONAL

Birth.—On January 7th, 1942, at Reading, to Adelaide Cotchin, M.R.C.V.S. (*née* Goulburn), wife of Ernest Cotchin, M.R.C.V.S., a daughter.

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R.C.V.S. OBITUARY

Deville, John Crossley, The Old Rectory, Bramshall, Uttoxeter, Staffs. Graduated N. Edinburgh, December 13th, 1895. Died December 30th, 1941 ; aged 70 years.

Gillespie, William Simon, Capt. late R.A.V.C., 32, High Street, Pershore, Worcs. Graduated London, July 14th, 1903. Died December 24th, 1941; aged 69 years.

Patrick, William Guy, Llanarth, Cardigan. Graduated London, December 18th, 1886. Died May 29th, 1941.

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Mr. J. C. Deville, M.R.C.V.S.

Mr. John Crossley Deville, M.R.C.V.S., of Uttoxeter, was a deeply respected figure in the veterinary life of the Midlands. As one of the " stalwarts " of the Midland Counties Veterinary Association his death will be widely mourned. He was senior partner in the firm of Deville, Bagshaw and Lea, of Uttoxeter, where he had been in practice for 46 years. We hope to pay more adequate tribute to his memory in our next issue.

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Mr. W. S. Gillespie, M.R.C.V.S.

It is with much regret, also, that we record above the death of Mr. William S. Gillespie, M.R.C.V.S., of Pershore, who passed away at his home, Sunnyside, Worcester Road, on Christmas Eve. Mr. Gillespie went to Pershore to practise in 1929 from Hertfordshire, where he cultivated land, as he did formerly in Cheshire, in conjunction with his work as a veterinary surgeon. *Berrow's Worcester Journal* says of him: " Though a man of retiring disposition and modest demeanour, Mr. Gillespie came to occupy a high position in the respect and esteem of the townspeople. His illness began in the late spring of the year, but he exhibited extraordinary determination in continuing his work until almost the end, which was unexpected and very peaceful. He came of good Scottish stock and was the eldest son of the late Mr. and Mrs. Gillespie, his father being a well-known miller, of Collington, near Edinburgh. The family is widely scattered both in the north of this country and Australia. He had the reputation of being a great lover of animals. He was also a bookman, and in him the town has lost a man of considerable charm."

Mr. Gillespie was a member of St. Malpas Oswald's Lodge of Freemasons.

To the widow and two daughters, the Misses Allison and Nita Gillespie, of Dorchester, deep sympathy is extended in their bereavement.

Mr. William Guy Patrick, M.R.C.V.S.

We are indebted to a fellow veterinarian and compatriot of the late Mr. W. G. Patrick for the following tribute.

Cardiganshire has been deprived of its oldest veterinary practitioner through the death of Mr. William Guy Patrick, which occurred on May 29th, 1941, at Llanarth. Despite his name, he was a Welshman, born at the Lion Hotel, New Quay, Cardiganshire, which was kept by his father, and is still in the hands of a member of the family. He studied and qualified at the London Veterinary College, on December 18th, 1886. He spent most of his long years practising on his native heath. He, like many more of his colleagues, did not figure often in the limelight, yet he was an up-to-date practitioner and was highly esteemed in the county for his outstanding character.

Patrick of Llanarth, as he was generally known, was an impressive figure. He stood well over six feet in height, with exceptionally fine features, broad shoulders, and an erect carriage. Undoubtedly the fine physique which he possessed almost to the end of his days was due to a great extent to his own strict code of travelling, neither on horse nor in a trap or automobile, all of which he waived in order to be a pedestrian. Thus his mode of travel and his appearance was Grecian. Kipling's descriptive character would apply in more than one sense to Guy Patrick—"he walked by himself." There were no half-way measures with him. A minister of the Gospel who called once with the writer to see him for the first time, afterwards remarked that he might have taken him to have been a colleague of his, judging by his conversation. There was quite a different aspect when another Minister's wife called him in the middle of a night to attend an ailing cow, in the last stages of pneumonia. When Patrick was diagnosing the case, the lady intervened and said "There is very little wrong with the cow." I refrain from quoting what he said to her: suffice it to mention that she would not mistake him to be a colleague of her husband!

Patrick detested hypocrisy, and set more than a purely physical standard of uprightness. His name will be well remembered in the agricultural districts between Abeaeron and Cardigan town, and he will be greatly missed by the farmers in the surrounding districts.

E. M.

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Death.—Downe.—Eileen Margery, dearly loved wife of Claud H. Downe, M.R.C.V.S., Diss, Norfolk, on January 10th, at a Nursing Home in Norwich. Age 29.

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ROYAL ARMY VETERINARY CORPS

The War Organisation of the British Red Cross and Order of St. John of Jerusalem gives the following as the most recent addresses of R.A.V.C. Officers, now prisoners of war:—

Colonel H. E. Gibbs, D.S.O. (Ex R.A.V.C.), Prisoner of War No. 82, Oflag VIII.

Major F. J. Eardley, R.A.V.C., T.A., Prisoner of War No. 995, Oflag VIB.

Major J. Clabby, M.B.E., R.A.V.C., Prisoner of War No. 12, Oflag VIB.

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The following announcement is made in *The London Gazette* dated January 2nd, 1942:—

Alexander Ian Robertson (221003) to be Lt., December 10th, 1941.

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A WAR MILK SCHEME

At a special meeting of the National Farmers' Union Milk Committee held in the first week of the New Year it was agreed to recommend to the Milk Marketing Board a scheme under which, from April 1st, the Board will buy all milk and deliver it at destinations agreed by the Ministry of Food. It is a war-time measure only, and important features are that the price shall be the same to all producers, independent of the region in which they are situated, and that the milk will be paid for on a quality standard. There will be provisions for tuberculin-tested and for accredited milk, and milk of an unsatisfactory standard (sub-standard) will be paid for at a lower price than that of ordinary milk, and will, when possible, be "manufactured." The primary object of the scheme, however, is to get a sufficient quantity of milk direct to the consumer. To provide an independent test of the condition and quality of the milk, the system of sampling and testing at all laboratories in depôts, dairies and elsewhere will be directly under Ministry control.

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THE CIRCULATION OF PAPER

There is now a great demand for paper by the war industries, but in order that ideas and facts may still be recorded and circulated it is vital that large amounts of paper should be available for printing. Veterinary and other scientific periodicals are already being restricted in size, but fortunately paper, like currency, can circulate, and we would therefore urge all members of the profession to respond to the appeal for waste paper.

The textbooks of student days which are now only of historical interest, old ledgers and bills, incomplete and unbound sets of journals which are never referred to, and the old stud books which grace most surgeries or consulting rooms and are usually relics left by previous generations of practitioners, must go to the salvage authorities. They will all help to maintain our own veterinary publications and the general scientific journals without which any increase in knowledge would become almost impossible.

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ANGLO-AMERICAN FARMING PROBLEMS: AN EXCHANGE OF NEWS

Addressing the Guild of Agricultural Journalists on Thursday of last week, Mr. L. F. Easterbrook, who recently visited the United States at the request of the Minister of Agriculture, said that the farmers of the Mid-West were hungry for every bit of news about British agriculture's part in the war effort. They were surprised to hear that the main problems of our farmers were much the same as theirs. While they had the same hopes and fears about the post-war period they were willingly adapting their farming practice to meet our needs of dairy products and pig meat. The United States Government, like ours, had discovered that the only true basis of agricultural policy is care of the soil.

Mr. Easterbrook said that agricultural journalists had the great task of promoting the closest understanding among farmers of the world, making them realise the identity of their interests and the possibilities for a permanent peace if they would unite in planning to provide the world with its primary necessity in abundance. As a first step an Anglo-American agricultural news service will exchange knowledge between the farmers of the two countries.

Mr. R. S. Hudson, Minister of Agriculture, read a message from Mr. Claude R. Wickard, American Secretary for Agriculture, which declared that American farmers would welcome the exchange of farm news with their British compatriots to seal their bond of friendship in the fight for freedom with the plough.

LIVESTOCK BREEDING AFTER THE WAR

We reproduce the contribution made by Dr. John Hammond under the above heading, to the series of articles covering some of the more important aspects of the future organisation of British agriculture which appeared in *The Farmers Weekly* of January 2nd.

There is a widespread feeling throughout the Democratic countries that post-war reconstruction throughout the world must be based on a higher standard of living for their peoples. The Atlantic Charter implied this.

A higher standard of living involves a greater consumption of animal products, not only in this country but also throughout Europe generally. To this end the countries of Europe will probably decide to establish intensive mixed farming, with milk, pigs, poultry, fruit and vegetables as the leading products. This type of farming not only offers most employment on the land, but owing to the higher prices such products fetch, offers those employed on the land a higher standard of living.

Thus, the bulk of the wheat and meat production will probably be left to the extensive farming areas overseas, which can produce these cheaply with little labour.

In this country likewise, the first objective for the better nutrition of the people will no doubt be the provision of adequate supplies of liquid milk for children and mothers. Fortunately this product is one in which no competition from imports exists, and the British farmer will have this market to himself.

The pre-war dairy cow population supplied only about two-thirds of what are the estimated post-war requirements, and so we are likely to see a great extension of the dairy industry. As the requirements for liquid milk consumption will demand a high standard of purity, there should be a great market for tuberculosis- and abortion-free, down-calving heifers. Many livestock breeders might, with advantage, specialise in rearing these to supply milk-producing herds which have no facility for rearing.

Added to these demands of our own producers, it seems probable that, for the few years after war ends, many well-bred dairy animals will be required to re-stock the areas of Europe devastated by the Nazis.

Just before the war, with the development of our bacon factories and fixed prices for bacon pigs, the pig population of the country had reached a record high level, and, although it is now sadly depleted owing to war-time necessity, there seems to be no reason why it should not develop to the same extent again after the war, by the same means as was employed before it.

This system enabled the British producer to have the first place in his own market, to which the Sydney Conference of Primary Producers agreed, while the public were safeguarded from excessive rise in prices by imports to meet their requirements after the British farmer had supplied all he could.

If this is done, there should be, therefore, a great demand for well-bred bacon type breeding pigs after the war, not only for ourselves but also for the European countries already depleted of their breeding stock.

While for several years after war ends the demand for meat—beef, mutton and lamb—from the continent of Europe will probably absorb a large part of Australian and American supplies, thus reducing the competition of these with home-produced cattle and sheep, it remains to be seen how far these overseas countries will subsequently continue that market. It seems not unlikely that Europe as a whole will be supplied with meat from the New World just as wheat has been supplied in the past, for, if their agriculture is to be put on a stable footing, milk and vegetable produce must form the basis of their agricultural policy.

Whether this will materialise or not is uncertain, however, and the few years of good meat prices following this war, owing to the demand of Europe (including Russia) for meat, should therefore be utilised to put our meat industry in order so that we may be able to compete on equal terms with imports.

The system which raised our pig population to its highest level ever merits consideration, therefore, for application to beef, mutton and lamb. The object of the Pigs and Bacon Marketing Schemes was to find an alternative way of taking surplus supplies of pigs from local markets and finding a sale for them in the expanding market of our large cities through the medium of the bacon factory.

A similar scheme for beef, mutton and lamb with the establishment of a number of suitably placed abattoirs in the main producing districts should serve to take off any glut of these from local markets. A fixed price according to weight and quality at these abattoirs would, as it did with pigs, soon control the prices in the local markets by keeping supplies there at a reasonable level.

By such means we could ensure that the British farmer had first place in his own market, and give him facilities to expand his livestock production, which is the main basis of land fertility, good farming and a prosperous countryside.

Past history has shown that, owing to lack of this alternative system of marketing, the chief competitor of a home-produced lamb is another home-produced lamb and not an imported one. When the sheep population rises above the average, prices fall until numbers go down again. Thus intensive production has been prevented.

The fixed prices given at abattoirs should be on the basis of quality of carcase, for, unlike wheat in which the imported article commands the higher price, home-produced meat is a far more valuable product than the imported and this relationship should be maintained to enable us to compete on equal terms with imports.

A scheme such as outlined above should enable our pedigree breeders of beef cattle and mutton sheep to find a suitable market here for their surplus stock as well as to supply pedigree stock to the overseas producers.

With the world-wide demand for meat in the years following the war, the pedigree breeder should find a good demand for his animals, although he should bear in mind the fact that in overseas countries good stud farms have now been established so that the demand will only be for the very best quality animals to supply their stud farms, which in turn are supplying the producers of commercial stock.

In conclusion, we should not be lulled into a false sense of security and inaction by the great demand for animal products after the war, when increased demand and reduced supplies will probably cause rises in prices. Rather we should use this breathing space to perfect our system of production and marketing of livestock so that it can withstand competition from whatever quarter it may come.

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SCIENTISTS IN CONFERENCE

At a conference of the Association of Scientific Workers which was held in London over the week-end, Sir John Orr, speaking on nutrition, said that between a third and a half of the population of the United Kingdom and of the United States did not enjoy a diet adequate for health in pre-war days. The national food supply should be sufficient to provide an adequate diet for the whole population, which should be within the purchasing power of the poorest family. If this were done there would be a great decrease in disease and an improvement in physique.

Dr. H. M. Sinclair, Department of Bio-Chemistry, Oxford, said that in the period immediately following the war there would be world-wide famine. The British Empire, the United States, and the U.S.S.R. should set up now an international committee of scientists to plan the adequate feeding of the allies during the war, and of the world when victory had been secured.

Mr. R. E. Foster, technical assistant in a war factory, said that a general feeling of frustration permeated all classes of workers who were prevented from producing by mismanagement and inefficiency in high places. In the research department at his factory, he alleged, the management did not place sufficient

importance on the part which research and development played in production.

"There is a complete lack of collaboration," he declared, "between production and research departments. In general, it is our considered opinion that production is being severely handicapped by lack of scientific planning and management, lack of co-operation between management and staff, and between staff workers and manual workers." There must be the right men for the right job, and they must take full responsibility for their actions. At present there was too much "passing the buck."

Professor S. Chapman, of the Imperial College of Science and Technology, said that a refugee Government in Britain had an army of highly skilled and able scientific men drawn from all parts of the world. He knew of one or two cases of highly skilled scientists who were kept digging potatoes and doing other unskilled work when there was a great shortage of skilled persons on the scientific side of the war effort. This scientific ability should not be wasted.

Professor H. Levy, of the Imperial College of Science and Technology, said that they had to see to it that in the highest positions in the Army, Navy and Air Force, and on councils which determined strategy and tactics, there were scientific men who had gained military experience. At present scientific experts in the Forces were only "back room men," and were given no scope for full-scale experiment in the field. The British war effort had been hampered by complete ignorance of the power of a planned economy, and the results of planning in Germany and Russia had been watched with amazement.

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SCIENCE AND THE STATE: NEED FOR FREEDOM IN RESEARCH

Sir Henry Dale, in his presidential address to the Royal Society at the 279th anniversary meeting, on December 1st, dealt with the increased preoccupation of science with the means of waging war and the relations between science and the State.

With Russia now locked in a supreme struggle for its existence and freedom, he said, and America directing its tremendous scientific and technical potential to the support of the same cause, the diversion of science from its normal uses and objectives had spread right round the world. Yet even this grim necessity had brought with it some measure of compensation in drawing closer the bonds of friendship between the men of science in the countries thus united in a common purpose.

Though the first and imperative call on the science of all free countries was for the winning of the war to save the freedom without which science could not in any true sense survive, they could not put aside the duty of preparing for the part science must play in rebuilding and maintaining civilisation when peace returned. He congratulated the British Association on the success of its conference on "Science and the World Order." Many who took part were clearly ready to support the view that science should be as fully organised as it was for war by the Governments of a world at peace. There were not wanting voices to sound a warning of dangers which might be entailed by such fullness of association.

Freedom and opportunity, it was pointed out, rather than organisation, provided the conditions for the highest types of research. He was in sympathy with that view. Between the two wars, however, the Royal Society had been given important funds to be administered for the support of researches over a wide range of subjects, in complete independence of any control by the State.

Support of Research

On the other hand, it would be agreed that the remarkable development in this country since 1914 of the State support of research administered by the three Advisory Councils had taken place without any obvious danger or detriment to the freedom of science. The Royal Society's function of advising the Government had been shared and greatly diminished. They could regard that as in many respects a realisation of the plans of their predecessors, and the society's traditions and standards were still effective through the influence of their Fellows on the Advisory Councils and as their chief executive officers. As a whole-time research worker since 1914, under the Medical Research Council, he could bear witness to the freedom of opportunity which could exist under an enlightened organisation and control.

While the existing mechanisms for the support of science by the State were doubtless susceptible of improvement, he found no reason to fear any threat to the freedom of science from them. Nor did he fear it from the wider use of the organised application of science and scientific method to problems of public welfare, nor again from a more effective access of scientific knowledge to those responsible for government. There was one direction, however, in which he saw some reason to fear for the freedom of science. If science should become entangled in controversial politics, through the over-eagerness of its advocates to invoke the sanction of science or to claim its potentialities in support of any special political doctrine, the threat to its freedom might become a real danger. If science were allowed to be used as a weapon of political pressure it would be impossible to protect science from the pressure of sectional politics. If that should happen the dangers were beyond dispute—the danger, for example, that fundamental researches having no immediate practical appeal would be allowed to fall into arrears through relative neglect; or the danger that the rigid standards of true science would be relaxed by allowing the convenience of results for policy or for propaganda to enter into the assessment of their validity as evidence.—*The Times*.

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ERGOT AND ITS ALKALOIDS

"The undergraduate confronted with the study of materia medica reads in his textbook that ergot is the sclerotium of *Claviceps purpurea* Tulasne, arising in the ovary of *Secale cereale* Linn. and in anguish he cries 'Can these dry bones live?'," observes *The Lancet* in a recent annotation on the above subject, which proceeds: "Yet in the history of galenicals such as opium, digitalis and ergot there are reflected many of the joys and sorrows of mankind. When the student is considering ergot he must give rein to his imagination and rove among the peasants of Spain and Russia who gather the drug for us, and he will find it a subject with fascinating ramifications into folk-lore, religion, epidemiology and even the fortunes of war. Ergot has yielded an astonishing crop of pharmacological discoveries, and it is unlikely that we have seen the last of them. The position has lately been reviewed by A. C. White,[1] who explains that at least five active alkaloids exist in different ergots, and each has a less active isomeride. Smith and Timmis[2] point out that these alkaloids can be arranged in a laevo-rotatory group which are pharmacologically active and a dextro-rotatory one which are much less so. In the active group are ergotoxine, ergocristine, ergotamine, ergosine and ergometrine; in the inactive group ergotinine, ergocristinine, ergotaminine, ergosinine and ergometrinine. They resemble the dancers in a reel in that they may perform alone or linked with weaker partners. Apart from various amines and acids ergot may also contain at least 14 alkaloids consisting of equimolecular complexes of dextro- and laevo-rotatory

(1) White, A. C. (1940.) *Edin. med. J.* December. 789.
(2) Smith, S., and Timmis, G. M. (1936.) *J. chem. Soc.* 1440.

alkaloids. The potentialities and pedigrees of these are still largely unknown, but in several instances their component parts are the common alkaloids of ergot. Thus sensibamine is merely an equimolecular complex of ergotamine and ergotaminine, and in the hands of the Koflers[3] the lowly origin of the others will no doubt be exposed; but the pharmacological follow-up has scarcely begun. More respect must be paid to ergomonamine, for Holden and Diver[4] have shown it to be of totally different type. White gives a valuable epitome of the pharmacological and toxicological effects of the ergot alkaloids in the fowl, cat, rabbit and mouse, and mentions that in the human subject the acute symptoms that they produce in the central nervous system include drowsiness and disturbances of temperature regulation and respiration; as he points out, this triad strongly suggests some hypothalamic site of action for these alkaloids. The observation is far from being merely academic, for the use of ergot alkaloids in migraine foreshadows a widening field of clinical application. The pathogenesis of convulsive ergotism is even more obscure. White says that the nearest he ever approached to observing convulsive action was when he noticed an occasional retraction of the head which might last some time and rarely an athetoid movement of the forelimbs. He is attracted by Mellanby's suggestion that convulsive ergotism is explained by vitamin A deficiency on which chronic ergotism is superimposed. As yet this view has not gained general acceptance, and it is unlikely that any conclusive work will be done on the subject in the so-called civilised countries, where gross deficiency of vitamin A is comparatively rare. In some parts of the world, however, the widespread occurrence of xerophthalmia indicates that vitamin A deficiency is common, and in such regions it should be possible for clinicians interested in experimental medicine to settle the issue."

(3) Kofler, A., and Kofler, L. (1937.) *Z. angew. Chem.* 50. 620.
(4) Holden, G. W., and Diver, G. R. (1936.) *Quart. J. Pharm.* 9. 230.

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THE BLOOD-BRAIN BARRIER

"The question of the permeability of the blood-brain barrier, more especially in relation to the pathogenesis of neurotropic virus infections, has recently been raised again by Doerr[1]" observes *The Lancet*, and continues: "Up to a few years ago it was generally believed that under normal circumstances colloids did not pass from the blood into the cerebrospinal fluid. Later observations have shown that foreign proteins, such as serum globulins, and especially antibodes, may pass the barrier, though the concentration found in the cerebrospinal fluid is always a minimal fraction of that present in the blood. It has also been shown that in animals it is possible to demonstrate the presence of a bacteriophage some 50mμ in diameter in the cerebrospinal fluid of animals provided that the whole of the cerebrospinal fluid is taken for examination, though as Burckhardt[2] has pointed out the passage of demonstrable quantities depends on a high concentration in the blood. Since it has been found that comparatively large protein molecules can pass from the blood into the cerebrospinal fluid, fresh investigations have been made with tetanus toxin. It was at one time believed that the toxin reaches the central nervous system by centripetal spread along the peripheral nerves, but experiments on the intravenous injection of tetanus toxin now favour the view that there is a direct spread from the blood-stream to the nervous tissues. Possibly a similar path is followed by diphtheria and botulinus toxins. Incidentally, Doerr seems to draw no distinction between passage from the blood-stream into the cerebrospinal fluid and passage from the blood-stream into the actual tissues of the brain and cord. Whether the two barriers are equally permeable under all circumstances would need further investigation. Doerr applies the findings obtained with bacteriophage and tetanus toxin to the question of the passage of viruses into the central nervous system. In the case of a few viruses there is undoubtedly centripetal spread by way of the peripheral nerves, but in the majority of cases it is suggested that the virus passes directly from the blood-stream to the brain or cord. Most workers would agree with the statement that if sufficiently large doses of any virus are given intravenously to suitable experimental animals virus will reach the central nervous system with the production of either an active or a latent infection. There will be less agreement with the statements that under natural conditions the liability to invade the nervous system is directly correlated with the number of virus particles in the blood-stream, and that the liability to invade the brain is lessened by prolonged passage in the central nervous system. For the yellow-fever virus and its neurotropic variant neither of these statements is accurate. No hard and fast rule, it seems, can be laid down for all viruses."

(1) Doerr, R. *Schweiz. med. Wschr.* June 8th. (1940.) 504.
(2) Burckhart, K. *Arch. Virusforsch.* (1939.) 1. 40.

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BREED "INVASIONS"

Scottish invasions into English farming appear to come in cycles. At the moment there is one taking the form of a decided "push" by the Ayrshire cattle into the remoter fastnesses of English dairying. The Ayrshire Society's persistent support of English fixtures, especially the Royal and the London Dairy Shows, is now bearing fruit, and English buyers have been busy picking up bulls at big prices in Scotland.

Friesians, on the other hand, are making headway in Scotland, an exchange which, with the continued demand for other favourite dairy breeds, emphasises the old claim that there is no single best breed—it all depends on climate, soil and personal choice.—*Farmer and Stock-breeder.*

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That a close connection exists between food supplies and the incidence of tuberculosis is well known, so much so that this disease is often mentioned as affording an index of the value of wages in terms of actual nourishment. When the Germans entered Warsaw in the Four Years' War and seized the available supply of fats, there was a rise in the number of cases of tuberculosis which became catastrophic; and the same calamity has always attended a sudden withdrawal of fat-contained foods in northern latitudes. Had the rationing scheme in this country lacked any important element, especially in respect of the distribution of fats, a sharp upward movement of the incidence of tuberculosis must have taken place and would have continued from year to year.—*The Times.*

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"Three million children are now taking milk at school. This represents 72 per cent. and is the highest figure ever reached."—Mr. Chuter Ede, Parliamentary Secretary to the Board of Education.

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The two great things which had happened in his experience in recent years, said Mr. R. A. Butler, Minister of Education, speaking at a meeting of Dunmow Farmers' Club, were that the land had returned, or was returning, to its historic productivity, and there was a spectacular change in the status of the Essex farm worker.

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Attention is drawn to the fact that, as intimated in our Notices Column, since our last announcement of the series of meetings arranged for the Section of Comparative Medicine of the Royal Society of Medicine to discuss the principles involved in a campaign to control certain diseases of cattle inimical to man, an additional meeting will be held on February 4th, at which the control of tuberculosis in cattle will be considered. "Mastitis and Streptococcal Infections" is the subject for the following meeting in the series, on February 18th.

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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CALMETTE-GUERIN VACCINE

To the Editor of the Veterinary Record

Sir,—About sixteen years ago when there was a great controversy going on about the Calmette-Guèrin vaccine, I decided to give it a trial on my herd of British Friesian Cattle.

As is well known, the bacilli that have been introduced into the body by means of the vaccine are supposed to be excreted, or otherwise eliminated, from it, in a non-infective form, by the end of 18 months. When this has occurred the increased resistance set up by the vaccine has, more or less, passed away, and a re-vaccination is necessary.

I wrote a letter at the time to The Veterinary Record, and said that in due course, I would report the result, whether good, bad or indifferent.

I obtained the vaccine from Weybridge, and employed it according to instructions.

At the International Veterinary Conference held in London, 1930, several members of the profession, one of whom was an Italian, spoke strongly in favour of the vaccine, but Professor Watson of the Bacteriological Institute at Ottawa, said he had tried it, and that it did not give any immunity against tuberculosis.

Six years ago, when I went over the Institute at Ottawa, I saw in Professor Watson's laboratory, *post-mortem* specimens of organs affected with tuberculosis, belonging to animals which had been vaccinated with Calmette-Guèrin vaccine.

After trying the vaccine for about twelve years, I reluctantly came to the conclusion that it did not give any immunity. It was, of course, a costly undertaking, especially as, after the animals had been vaccinated, they would not pass the tuberculin test, which naturally depreciated their value considerably.

Yours faithfully,
Graham Rees-Mogg.

Clifford Manor,
Stratford-on-Avon.
January 2nd, 1942.

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THE ECONOMIC FACTOR IN THE TREATMENT OF PARATYPHOID IN PIGS

To the Editor of The Veterinary Record

Sir,—Your correspondent, Mr. H. C. Swann, has raised a point of great importance in relation to paratyphoid in pigs. A good deal has been published on the treatment of paratyphoid but I would point out that the word cure has a special meaning in this disease. Many pigs recover naturally and recovery may be hastened by treatment, but that the recovered animal is normal may not be assumed. Pigs are kept for their capacity to turn meal efficiently into pig, and as food is by far the largest item in the cost of producing pigs, any lowering of efficiency will have serious effects on the profits of the undertaking. The extensive work published by Murray, Biester, Purwen and McNutt in 1927 and 1928, and amply confirmed at their laboratory, has shown that the damage to the bowel occurs with great rapidity. This damage is repaired in every animal that survives but the efficiency of the organ is lowered. Data obtained here with experimental paratyphoid, using comparatively minute doses of culture, demonstrate this reduced efficiency clearly. If farmers weighed pigs regularly during all stages of growth, their respect for necrotic enteritis would be greatly increased and they would look more kindly on efforts to find means of prevention.

Yours faithfully,
G. Slavin.

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THE CONTROL OF ANIMAL DISEASES

To the Editor of the Veterinary Record

Sir,—The State alone can provide the means whereby the fullest use may be made of the opportunity presented by the reduction of stock, to build up sounder herds from those which remain, for the post-war years. No amount of enthusiasm unsupported by the State can achieve this.

Whilst few will disapprove of the broad outlines of the Report of the Survey Scheme, very few can agree that in its present form, plus a possible State benediction, it is capable of successful prosecution.

A great deal of laboratory assistance will be necessary, and it would be true to assert that with the exception of a gifted minority, the average general practitioner is only able to find time to practise such simple methods, requiring the microscope, as the examination of a blood smear or skin scrapings. In the much wider field envisaged, such as the successful control of mastitis, he will certainly not have the time to examine milk samples, or be able to provide such facilities at his own expense.

One is cognisant of the fact that the proposal to transfer the control of further diseases to the State is not universally popular, but I, for one, fail to see how it can be exercised otherwise. The Animal Health Branch of the Ministry of Agriculture and Fisheries has well-equipped laboratories at its various divisional headquarters and very little development is necessary to place these at the full disposal of all those participating in any scheme to control diseases of farm livestock. It is as one with no axe to grind that I urge most strongly that this Branch alone be entrusted with all matters pertaining to livestock. Those engaged in cattle practice are painfully conscious of the inability to check the heavy annual losses from abortion in herds which have gone to the expense of acquiring a T.T. licence. It is not possible to fathom the mentality which whilst prohibiting immunisation took no steps to exercise control over animals in such herds, with a natural infection, and which unless all the teachings of bacteriology are wrong, should be the most dangerous. The transfer of the control of this disease to the Animal Health Branch would result in its effective control.

It appears to be overlooked that the State is alone able to introduce legislation, and to disseminate education. A great deal has been written on the causes and treatment of the varying forms of infertility, but very little on the origins of most of it, namely: (1) inattention to the elementary principles of hygiene at the time of parturition, and (2) the failure of the various cattle societies to realise that breeding cannot be treated as a purely "family affair."

Side-shows, no matter how immaculate in their conception, perish if left to individual effort and enthusiasm. Faced with the example of the present position of N.A.R.P.A.C., which is due to it not being incorporated with and thus securing co-operation from, the A.R.P. services, I hope that the profession will not be so foolish as to embark upon the control of further diseases of livestock, unless the venture is incorporated with, and thereby gets co-operation from, the Animal Health Branch of the Ministry. If, at the moment, it is not possible for this Branch to give this, then the profession will be well advised to endeavour to do the best it can in a purely private capacity, for it will certainly get more "kudos" in the end by so doing.

Yours faithfully,
J. F. D. Tutt.

"Rothiemurchus,"
St. Cross,
Winchester.